THE MINERAL AND THERMAL SPRINGS OF UNITED STATES AND CANADA BY…

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THE

MINERAL AND THERMAL

SPRINGS

OF THE

UNITED STATES AND CANADA.

BY

JOHN BELL, M.D.,

AUTHOR OF "BATHS AND MINERAL WATERS;" "BATHS AND THE WATERY REGIMEN;" LECTURES ON THE PRACTICE OF PHYSIC; "REGIMEN AND LONGEVITY;" "DICTIONARY OF MATERIA MEDICA," ETC. ETC. ETC.

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TO

LEWIS WALN, Esquire,

This Small Book

ON A GREAT SUBJECT

IS INSCRIBED,

IN TESTIMONY OF ESTEEM,

BY

THE AUTHOR.

PREFACE.

THE want of a manual in which travellers for curiosity and pleasure, and invalids in quest of health, might learn where to go, how to go, and what to find, in relation to the Mineral and Thermal Springs of our country, has been generally felt. Physicians, too, have wished for a work to which they could refer for information respecting the physical and chemical properties and medicinal virtues of the several springs. There are, indeed, some published accounts of particular springs, and even groups of springs, as, for example, of those of New York and of Virginia, of which free use has been made in the following pages. But, with the exception of a work by the author, issued twenty-five years ago, no attempt has hitherto been made to collect and arrange methodically the numerous separate and scattered histories and descriptions of the different mineral and thermal springs of the United States, as has been done for those of Great Britain and Ireland, of France, of Germany, and, in a more restricted manner, of Italy.

Duly elaborated and refined, and fitted for immediate use by an all-wise and beneficent Creator, these waters constitute a large and important addition to our Materia Medica. They come to us with the recommendation, not only of their known curative powers, but also, of their supply being perennial and inexhaustible, and exempt alike from change and adulteration. They are offered, moreover, with the associated advantages of pure air, new and often romantic scenery, and enlivening company; for it is now understood that Pleasure and the Graces are also visitors to the fountains of Hygeia. Thus are the best means combined together for the renovation of the wasted and sickly frame, and for an infusion of hope and cheerfulness into the mind ill at ease, if not weighed down with care.

Like every other gift, this one may be, and, unfortunately, often is greatly abused, owing to ignorance and false theory, and an impatience to obtain decided results within a period far short of that which Nature requires to accomplish the intended purpose. Measuring efficacy by quantity, invalids often commit excesses which aggravate, instead of soothing and ameliorating their complaints. So, also, a want of adaptation, in the time of drinking the mineral water and of using the bath, to their actual condition, is productive of injury; and bad effects are attributed to the remedy itself, which are owing to the indiscretion of those who made improper use of it. The author, in the following pages, has endeavored to guard visitors to watering places against repetitions of these and other mistakes. With this view he offers suggestions and advice susceptible of general use and application; leaving to the regular medical adviser the exercise of his privilege in giving those minute directions which may be required by the constitutional peculiarities of the invalid, and the stage and other circumstances of the disease under which he labors, and for the cure of which he goes to the Spring selected for the purpose.

An invalid, once arrived at the Spring, although he may have been influenced in his selection by what he may have read in these pages, is not to suppose that the information thus acquired can enable him to dispense with suitable medical advice, if it can be procured, on the spot. It would be a wise economy in all who propose to drink the water, to indicate to the resident physician their intentions, and to obtain from him an outline of the precautions to be taken and the course to be pursued during the period of his stay.

The strictly medical portion of the present volume is intended for the perusal of the professional reader. The general one, whether traveller or invalid, will, it is believed, find in other parts of it matter for instruction and interest, without his engaging in the recondite questions of pathology and therapeutics. Apart from its hygienic features, there are others relating to the natural history of mineral and thermal springs, well adapted to excite, and, to a certain extent, gratify the curiosity of an inquiring mind. A description of the temperature, composition, modes of issue of these waters, and the nature of their deposits, and the geological appearances around, can scarcely fail to awaken an interest in the most indifferent. It is barely necessary, in illustration of this point, to refer to the Geysers and the Stokkr, the Spouting Springs of Iceland; or to the alabaster deposits at the Baths of San Filippo, in Tuscany, furnishing materials for medal and bust; or to the wavy terraces formed by the springs of Heliopolis, in Asia Minor, and the miniature temples, as if for a dwelling of the Naiads, deep in their waters. In the Boiling or Carbonated Springs of Kansas, the Beer Springs and the Steamboat Spring in Oregon, the Hot Springs of Pyramid Lake in Utah, and the Volcanic Springs of California, we have equally rare and striking pictures of nature under new and varied aspects. At some of these spots, the people of the Atlantic and Pacific States will, ere long, meet in convention to adjust questions of State politics and Church discipline; or, on pleasure bent, will here keep high holiday.

The author has arranged the materials gathered from a variety of sources, in such a manner as to show the distances and bearings of the different springs of the great West from each other, and from some striking object in nature—a river, a lake, or a mountain range, so as to enable the reader to find them with comparative ease on a common map.

It may be well to say, in explanation of the moderate size and scope of the present volume, that, although entire in itself, the subjects of which it treats were intended to be included in a larger work on mineral and thermal springs in all parts of the world. That which is now introduced to public notice with a hope that it will promote the public good, must, therefore, be regarded as an earnest of the intentions of the author, and an instalment of his accumulated stores. The larger work will embrace the natural history of springs, common as well as mineral and thermal, and a description of the successive steps of mineralization, begun in the atmosphere, and continued in the successive stages of the percolation of atmospheric or meteoric water, in the form of rain, melted snow, and precipitated vapors, through various and successive strata of earths and rocks, where it is impregnated with different saline and mineral substances, and then emerges from its subterranean channels as a fountain or spring, with all its newly acquired, but, at the same time, permanent characters. Next come up for consideration thermalism, and the connection between thermal springs, and volcanoes and subterranean and central heat. Artesian wells, the waters of which have so close a relation to those of common springs, by community of origin; of mineral ones by their frequent mineral impregnation; and of thermal by an increase of their temperature with that of their depth—have received a full share of attention. The author, in his investigation of these subjects, has followed the voyagers of circumnavigation and discovery, and other travellers and zealous missionaries in their wanderings and adventures. He has put under contribution journals of science, and the transactions of learned societies, and, in this way, he has collected accounts of mineral and thermal springs in greater number, and over a wider range, than has yet appeared in any single work.

In thus leaving the beaten track and seeking out sources of information in quarters hitherto overlooked, the author has written a kind of Itinerary, in which he has not confined himself to a mere enumeration of the various springs, and their geographical situation in general. He has introduced, in addition, topographical sketches, descriptive of localities and scenery; and he has made frequent references to historical events and great names associated with different springs—as of Leonidas and his three hundred performing their last ablutions at the Hot Springs of Thermopylæ; Aristotle revisiting those of his own Lesbos; Hannibal at the Warm Baths of Brusa, and Cicero and his "Academy" and a long list of other illustrious Romans, in connection with those of Baiæ; Pliny the Elder, at Stabiæ, taking his last look at the, to him, fatal eruption of Vesuvius; and Charlemagne holding court in the great bath at Aix-la-Chapelle, &c. &c.

Not only will the springs of Europe with their physical and chemical characters and medicinal effects be described, but groups in all other parts of the world will obtain adequate notice. Already he has passed in review, and made due record of the mineral and thermal springs of Asia Minor, of Circassia and the Caucasus, of Hindostan and Thibet, on each side of the great Himalaya range, of Central and Northern Asia to Kamtschatka, and of North and South Africa. The islands from Iceland to New Zealand, and thence to those of Japan and the Aleutian group have been similarly visited, and their hydrography and thermography described. The line of the Andes, followed from the Straits of Magellan to the Isthmus of Panama, and Mexico, with her mountains, examined, the author will then have collected his materials, and be ready to impart all that he has gleaned with so much labor and time, to the reading public.

Reverting to the volume now completed, it will be found to contain notices, more or less full, of one hundred and thirty springs and groups of springs belonging to the United States. If account were taken of each separate spring of the several groups, which is marked by distinctive properties, the number would exceed two hundred. Of those described, there are, as will be seen in the tabular view presented in the Appendix, about thirty of the thermal class, a great majority of which must be quite new to most readers.

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MINERAL AND THERMAL SPRINGS.

CHAPTER I.

Chemical division of mineral waters—Their efficacy as remedial agents inquired into—Hygienic precautions for visitors to mineral springs—Clothing, diet, sleep, amusements, exercise.

MINERAL SPRINGS will be spoken of in these pages under the heads of—1. *Acidulous* or *Carbonated.* 2. *Saline.* 3. *Sulphureous.* 4. *Chalybeate.* To these some add two other classes, the Ioduretted and Bromuretted, and the Acid. The name of the first of these two designates their predominant traits. The second or acid includes those waters, comparatively few in number, in which there is an excess of sulphuric acid, usually with alumina and iron, as sulphates. In Virginia, they are called Alum Springs.

1. *Acidulous* waters are sometimes called gaseous, on account of their containing

and evolving gas—which is chiefly carbonic acid. Owing to this ingredient they are sparkling, stimulant, and agreeably pungent to the taste. They hold in solution various saline substances, in which, for the most part, the carbonates, first and mainly of lime, and then of magnesia and soda, predominate, with the addition often of the carbonate of iron and chloride of sodium, or common salt. These waters are occasionally spoken of as alkaline.

2. *Saline* waters, as their name implies, abound in salts, of which the sulphate of magnesia or Epsom salts, and the sulphate of soda or Glauber's salts are, medicinally, the most active, while chloride of sodium, a common constituent, adds to their virtues in this respect. Sulphate of lime, which is of little therapeutical value, is quite common in this, and still more in the acidulous and sulphureous classes. Carbonic acid abounds in some of the saline waters, entitling them to be called *acidulo-saline.* A remarkable example of this union is met with in the Saratoga springs.

3. *Sulphureous* waters are characterized by

their odor, which is due to the escape of sulphuretted hydrogen gas (hydrosulphuric or sulphohydric acid) or to the presence of an alkaline sulphuret. They strike a black color on the addition of acetate of lead, and impart a dark hue to silver and other white metals. They have been divided into 1st. Hydrosulphureous waters, which contain free sulphuretted hydrogen gas. 2d. Sulphuretted or hydrosulphuretted waters, in which the sulphur is combined with metals, most generally with sodium, in the state of a sulphuret. 3. Acidulo-sulphureous, which hold carbonic acid in addition to the gas just named. 4. Sulphuretted acidulous waters, which contain at the same time a sulphuret, carbonic acid, and sulphuretted hydrogen gas. 5. Chalybeate sulphureous, which hold iron in solution.

4th. *Chalybeate* or *Ferruginous* waters are readily recognizable by their taste, compared usually to that of ink, which, as most readers know, depends on the iron which enters into its composition in union with a vegetable astringent. Chalybeate waters are discolored by tincture of galls, and eventually give, by this addition, a black precipitate; with ferrocyanate of potassa the precipitate is blue. By contact with the air, they deposit gradually reddish flocculi of the oxide of iron. Most of them are cold, and the iron is in the state of a carbonate of protoxide dissolved in carbonic acid. This salt is precipitated to a certain extent by exposure of the chalybeate water to the air, and still more readily when it is subjected to heat. In a few instances the iron is combined in the form of a sulphate, and in others, as Berzelius has shown, it unites with organic acid, in the state of a crenate or a procrenate.

Another division of mineral springs is into cold and thermal, one which is applicable to all of the four great classes, for we have cold and thermal acidulous, cold and thermal saline, &c.

In imitation of Bischof, I shall use, in these pages, the term *thermal*, to designate any spring, the temperature of which throughout the year is steadily above that of the common springs, or above the mean temperature of the soil, of the district in which it is found.

He who desires to speak of Mineral Waters as remedial agents, in an impartial manner, finds himself somewhat embarrassed between two extremes of opinion; one of which inclines to a belief in their surprising and almost miraculously healing powers; the other, bordering on skepticism, can see nothing in even the admitted beneficial results of visits to watering places but the working of imagination, and the changes brought about by travelling, new and pleasant scenes, regular hours, and relaxation from the toils of labor, and the cares of business. The first extreme can only be treated as a modified empiricism, which would convert good remedies, under properly defined circumstances, into panaceas of universal application, and never failing efficacy. The skeptics, on the other hand, require to be reasoned with, although, in truth, their arguments are hardly more logical than those of the empirics.

The question, after all, is one to be determined by observation and experience. Now it is an undoubted fact that many mineral waters hold in solution ingredients similar to those of admitted activity, which we find in the apothecary's shop, and which are compounded and directed according to formulas, laid down in the pharmacopœia and the dispensatory. And again, it is equally certain that these ingredients are often in such quantities, in the waters, as to produce marked sensible effects, as purgatives, diuretics, diaphoretics, and antacids; means universally admitted by observing physicians, in all ages, to be those by which a large circle of diseases is combated and overcome. But mineral waters, when drank in certain prescribed quantities, and when, under defined circumstances, used as a bath, not only produce the therapeutical effects of medicines obtained from the shops, but they do it with more ease, and with less perturbation, and even in a painless manner. Shall we then deny to these natural compounds, with the admitted adjuvants of better air, exercise, new scenes, and pleasant company, a power and efficacy which is so readily conceded to them in a sick chamber at home, with its too often unavoidably depressing influences and associations?

Nor do we find the cure of many diseases at watering places, by drinking the waters, confined to those who have left the crowded city and its unwholesome air. The inhabitants of the country are often equally benefitted by the same course of treatment, although they cannot be said to enjoy the additional advantages of change of air and of rural scenes obtained by the other class. In regard to the state of the mind, and particularly an active imagination, by its influence on the body, explaining the good effects of visits to mineral springs, we do not find, by any means, that the most imaginative are they who report the most favorably, or who exhibit by cures in their own persons, the sanitary powers of the waters. On the other hand, the dull, unlettered clown, or the exacting logician and mathematician will often come away cured of their dyspepsia, torpid liver, rheumatism, or long-endured cutaneous disease, by drinking these waters, without any exercise of the imaginative faculty, either to have relieved or persuaded them that they had found relief; and to whom society would be more irksome than agreeable.

Animals, moreover, such as horses and cattle, and dogs, and even the literal swine have been evidently cured of obstinate maladies by this means, without our being able to divide the credit of the cure with country air, change of food, and pleasant company. Wild animals, prompted by conservative instinct, resort in large numbers to salt-sulphur springs or "licks," and take freely the unpalatable sulphureous ingredients for the sake of the saline.

In chronic maladies, the physician has recourse, with avowedly good effect, and on what is regarded a philosophic basis, to the administration of medicines in minute, but still appreciable quantities, constituting what is called the alterative practice. In these cases, beneficial results, by the great abatement or entire removal of disease, are brought about in a slow and scarcely sensible manner, without purging, increased diuresis or sweating. So, in like manner, do mineral waters, if their ingredients be few and of no great activity, or, more especially, if small quantities of the stronger ones be given, act as alterative medicaments. Time is an important element for the amelioration or cure, whether the artificial remedies from the shop, or the natural remedies from the great subterranean laboratory be the means employed. Not unfrequently weeks, sometimes months will elapse after the invalid has left the spring, before he realizes the salutary operation of its waters, in obviously amended health, and greater strength and spirits; and yet these results are often obtained, in despite of the counteracting influences of return to the old habits of business, with its cares, confinement once more to the city, and want of exercise in a pure air.

The sensible changes produced in the blood and the secreted fluids by the ingestion of certain mineral waters, and even by bathing in them, afford strong evidence of their physiological action; and would, *à priori*, lead us to infer beneficial therapeutical effects and renovation of the system, which had been suffering from disease, by the use of the same means. A single bath in the hot waters of Vichy, which abound in carbonate of soda and carbonic acid, renders the fluids even of gouty persons alkaline, which had been previously acid. It certainly requires very little faith to make us believe that the regular use of these waters, internally and externally, for a month or two, must powerfully modify the morbid state of the assimilating functions, as in gout and renal diseases; and if we falter in our anticipations of good in this way, experience comes in to remove all doubts, and establish our favorable convictions.

Skepticism has made large use of and converted into ridicule, the alleged medicinal powers, and the cures brought about by means of certain waters, in which chemistry has failed to detect active ingredients, or, if any, these were in such small quantities as to be, it is thought, necessarily without effect. To this it may be replied, that chemistry is sometimes at fault, for a considerable period; but, ultimately, with improved science and more delicate processes, therapeutical agents of great energy have been found in waters which previously had been believed to be pure or slightly impregnated with foreign substances. Among these agents may be mentioned iodine and bromine, and, of late years, arsenic. An announcement of the presence of this last in mineral waters, may startle many persons, until they learn that this metal is in such minute, but still appreciable proportions, as to place it safely on the prescribing list. Small as are the doses of arsenical preparations, in our existing *materia medica*, they are still beyond those in mineral waters drank in the ordinary quantity. The reference is made at this time, however, to show that neither the sensible properties of certain waters, as measured by taste and smell, nor their chemical analysis, when furnishing negative results, are proofs of the absence of medicinal properties and curative powers in these waters. Accident at first, sometimes the experience of the aborigines on the spot, suggested by a resort of the wild animals of the forest to the springs; sometimes the traditional, but abiding reputation of their virtues among the country people around, who had used them in certain complaints with obvious benefit, preceded the more methodical trials of educated and scientific inquirers, and furnished a large body of experimental proof, which ought to have more weight in guiding us to a right decision, than all the reasonings and deductions from data of another kind.

The most practical men, as many of our non-reading, and we fear we must add unread physicians, love to be called, are in the habit of prescribing preparations of iron as a tonic, which of all the metals, and indeed of all the medicines of this class, is most congenial with the organism, and which exerts in many disorders of the anemic kind such benign and renovating effects. Now many mineral waters hold in solution this tonic, and in the state, too, of a carbonate, which is generally admitted to be its most active form, and one which is not easily retained in our customary medicinal preparations.

HYGIENIC PRECAUTIONS IN VISITS TO WATERING PLACES.

These come under the heads of clothing, diet, sleep, and amusements. In our climate, or we may say series of climates, within the limits of our vast confederacy, no person of common prudence ought to leave home, for even twenty-four hours, in the summer months, without having at hand a change of warm clothing, including inner garments, and those for external use and show. Owing to the situation of most mineral springs in valleys, or at the foot of a lofty range or mountain, the air of the place is cool and damp at nights, and in the early morn and evening, even although the heat may have been considerable during the day. It becomes necessary, therefore, for invalids and persons of delicate frames to guard against these changes, which are still more trying during a period of rain with keen easterly winds. No matter what may be the malady or the organ affected, the probability of cure will be lessened by checked perspiration, or interference with the functions of the skin, so that it is chilled or thrown into an atonic state through cold and moisture. If the happy medium of temperature cannot be preserved, it will be safer for the invalid to keep the skin moderately excited by flannel, merino, or silk worn next to it, than to allow it to be, at any time, cold, and wanting in activity of capillary circulation. I shall not enlarge on this point here, as in another work (*Baths and the Watery*

Regimen) I have spoken in detail of the sensibility of the skin, and of its sympathies with other organs, and the conditions for preserving its functions, as offered in clothing, exercise, and bathing. The exposure encountered by persons of the other sex in putting on light attire, and leaving the arms and, at least, the neck bare, dancing in crowded and hot rooms, with an occasional escape into the piazza and its cold air and drafts, brings with it new ailments and the aggravation of old ones—a result foretold, in tones of warning and often of earnest entreaty, but which are too often disregarded or laughed at. Laugh and ridicule and disregard the laws of nature as we may, we cannot escape the penalty for their infraction. They are part of the ordinances of Nature's God, and can neither be evaded nor abrogated by his creatures.

Although it is not often necessary in chronic diseases, as met with in invalids at watering places, to enforce very rigid dietetic rules, it will always be desirable for them to avoid extremes and excesses in the quantity and quality of the food, and to take it at hours, as nearly as may be, the same as those to which they had been accustomed at home. The selection of dishes must be made with due regard to their own personal experience, not of what they like as palatable, but of what they know to be easy of digestion. As a general rule, the drink at meals and in the intervals between them ought to be water of such a temperature as best agrees with the stomach. They who wish to give mineral waters a fair trial, and to derive the fullest effects from their excursion to the Spas, will abstain from alcoholic drinks of all kinds, not excepting the sparkling champagne with its bubbling imposition and falsehoods, persuading the credulous drinker that it came from the vine-clad hills of France, when, in fact, the greater part of it first saw light in some obscure manufactory of factitious liquors at home. The ladies, on their part, will have to practise abstinence from another beverage, the decoction of the Arabian berry, as it is phrased by poets and fine writers, and, in the vernacular, coffee. In inflammatory and irritable habits, and in those who suffer from abdominal congestions and irregular action of the heart in either sex, coffee is very injurious. The nervous and hysterical, they who cannot sleep, and who are on springs, jerky and fidgety, now in the seventh heaven of sublimated sentiment, and again in the depths of despondency, complaining, and begging for sympathy, without offering any in return, will have to abandon the use of tea. If either it or coffee be taken at all, they ought to receive so large an addition of good milk or cream as just to allow of their flavor being retained. In this way the drinker may escape the disturbing effects of these beverages on the nervous and digestive systems.

Sleep, like other true friends, is most welcome when it comes uninvited, without coaxin or wooing, as it generally does in the evening, after due exercise and rational amusements during the preceding day. But sleep can hardly be expected to approach those who have shut it out at the customary hour of its visit, and who only seek it after midnight, with their hearts beating wild yet weakly, their temples throbbing, their whole system heated, excited, and jaded by the close air of a crowded room, and perhaps the rapid whirl of the waltz and the, at least, not graceful movements of the exotic polka, which, we must hope, will soon die for want of cultivation by those who make any pretensions to refined taste.

They who would visit, as they ought to do, the mineral spring before breakfast, must rise early, which implies that they have gone to bed in proper time, so as to allow themselves eight hours' sleep. Some will be content with six hours. This will be the minimum, as the first mentioned period will be the maximum, compatible with health and the due exercise of both body and mind.

Exercise, both as regards kind and amount, will be regulated by the constitution and practice of individuals themselves, provided they had been in the habit of taking daily exercise at home. After every allowance made for individual peculiarities and particular infirmities, it may be laid down, as a general rule, that all the visitors at the springs ought to take daily exercise on foot or on horseback; the time and distance being such as to prevent a feeling of much fatigue, or exhaustion. In fact, exercise and recreation ought to be combined; and amusements, to a certain extent, should come under the same head. Could the dance be enjoyed at proper hours, adequate space and ventilation being obtained at the same time, and the dancers attired in a suitable, easy-fitting dress, it might come under both the heads just designated. Various gymnastic exercises for the men, and calisthenic for the other sex, so arranged that they could be taken in the same enclosure, would increase the beneficial action of the waters, and contribute not a little, in many instances, to the restoration of invalids to health.

No active exercise should be taken for, at least, an hour after the chief meal, nor should a bath of any description be taken until a much longer period has elapsed after eating heartily. The better time for both is in the early part of the day.

CHAPTER II.

Rules for drinking mineral waters—Time of the day—Best in the morning early—Repetition—Same rule for bathing—Quantity drank—Different temperatures of the water drank—Cold—Tepid—Hot—Condition of the invalid modifies the effects of the waters—Bathing while drinking mineral waters, and rules for the use of the bath at different temperatures—Division of baths.

RULES FOR DRINKING MINERAL WATERS.

As travelling is always productive of more or less febrile excitement and fatigue, the visitor at the springs ought to rest a day or two after his arrival, before he begins to drink the water. A warm or tepid bath may be taken in the meanwhile.

The proper time for drinking a mineral water is early in the morning, an hour at least before breakfast, when the stomach is empty, most impressible, and most readily transmits the effects which it experiences to the other organs. The water ought not to be drunk when the stomach is engaged in the process of digestion, and, of course, not for several hours after a meal, especially dinner. A neglect of this precaution in drinking mineralized water, not only prevents its salutary operation, but disturbs digestion, and interferes with those changes which the food ought to undergo in the stomach to prepare it for being assimilated to the fluids of the body, and especially to chyle, or first blood.

If the water is to be taken a second time in the day, this should be two hours before dinner; and if its use be admissible at all in the evening, it can only be on condition that the dinner had been eaten at an early hour, we will suppose one o'clock, and that no repast had been subsequently taken, except perhaps a sandwich or a slice or two of bread and butter. As remarked in my first work on the subject,* "An invalid may drink a moderate quantity of the water before breakfast with comfort and advantage, but not be able to do the same before dinner with equally good effects. He may be able to take the water both before breakfast and before dinner, and yet if he drink in the evening he will, perhaps, have a restless night, and be worse next morning than he had been twenty-four hours before."

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* On Baths and Mineral Waters.—1831.

If modifications of the rule now laid down be admissible, it will be in the case of the milder mineral waters, such as the acidulous, in which carbonic acid often abounds, and which also hold in solution common salt. But the strongly saline, the sulphureous, and the chalybeate cannot be drunk with impunity, either on a full stomach, or during the time of stomachic digestion, and before the food has been converted into the somewhat homogeneous mass of chyme, and has, in great part, passed out of the stomach.

The same rule, precisely, will govern in the use of the bath, except in the case of a cold one, which should not be taken at all in the evening.

Imperfect sleep on the preceding night, or fatigue and languor from late sitting up and dancing, will impede not a little the expected effect of the morning draughts of mineral water, and if it be of the purgative class, ought to prevent its use altogether for that day.

The quantity of water drunk at one time must depend on various circumstances—its nature, strength of mineral impregnation, condition of the patient, and the immediately sensible effects expected. When taken with a view to its purgative operation, the quantity will be much more than when an alterative or even a diuretic, or diaphoretic effect is desired—supposing always that the same water is used to meet these different indications. But where others of less activity can be drunk in quantity without oppressing the stomach, they will be more likely to act on the kidneys and skin, and promote free secretions from these organs.

Modifications of effect may be expected from the different temperatures at which mineral waters are used. Common water, when cold, is rapidly absorbed, saline or mineral but slowly, and if the dose be considerable, both are eliminated through the kidneys. If the temperature be somewhat raised, so as to approach the degrees of tepidity, the stomach no longer receives either common or mineral water with the same complacency; and if they do not cause nausea, they excite this organ to expel them, and acting in the same way on the intestinal tube, they give rise to a purgative operation. At a more decidedly elevated temperature, or that which brings simple water to the standard of hot, it is again better borne by the stomach, is absorbed freely, and excites both pulmonary transpiration, and copious sweating. When the water is saline or mineral and at a high temperature, it also will act in the same way on these organs—lungs and skin—provided the impregnation be not very strong. The temperate degree, approaching the tepid, is the most favorable condition for mineral water, particularly of the saline class, producing a purgative effect, as it is also that for creating nausea and vomiting. In both instances, it stimulates the muciparous glands to increased secretion.

Certain modifications in the therapeutical action of mineral waters, and of other medicinal substances, will depend on the condition of the invalid at the time, so that their powers shall be exerted on one organ in preference to another. Thus certain saline and vegetable substances will either cause vomiting or sweating, will act as diuretics, diaphoretics, or expectorants, according to the state of the skin, its feverish heat, or its coldness, its warmth by clothing, or its exposure, at the time, to dampness and cold.

If the water be too cold for the stomach, it may be kept in corked or otherwise well-closed vessels, in the room of the invalid, until it acquires the temperature of the air, or, if need be, immersed in warm water, so as to render it slightly tepid.

BATHING IN CONNECTION WITH THE DRINKING OF MINERAL WATERS.

I alluded, in a preceding page, to the prominent part which bathing was made to perform in the medical treatment of invalids at the watering places of France, and still more of Germany. In similar places in the United States, the bath is either entirely neglected or is regarded as a thing of secondary or small moment; and hence the defective arrangements in this particular, at most of our mineral springs. The bath houses, when constructed, are too often small, damp, and gloomy, and placed out of the way, instead of being near to, if not directly connected with the springs, or the main building in which the visitors take up their abode. There is seldom adequate provision made for that most important variety of the bath, the *douche*, which, at different temperatures, cold, warm, or hot, is so powerful an agent in the cure of many diseases.

The temperature and duration of the bath will, of course, vary with the degree of vascular excitement and heat of the skin of the invalid, as well as with the indications which are proposed to be fulfilled by drinking the waters. When the saline aperient waters are employed with a view to diminish plethora, and the remains of febrile excitement, the temperate or even the tepid bath will be found the best adjuvant; the stay in it short. So, also, when acidulous waters are given with reference to an alterative action, and especially where it is intended to promote the secretion from the kidneys, baths of this kind will be found serviceable. The action both of purgatives and diuretics is favored by cool skin, so, on the other hand, their operation would be retarded and rendered incomplete, by stimulating this organ, as in the case where baths of a high temperature are had recourse to.

When it is desired to keep up a full capillary circulation in the skin, and to favor insensible perspiration, so as to allay irritation and prevent any vascular strain on internal tissues and organs, the warm bath will be found the most appropriate means for the purpose. It will be used auxiliary to alterative doses of sulphureous waters, and to the tonic treatment by chalybeates, in those cases in which the latter are used for the relief of languor, debility, a pale and dry skin, and a soft and rather feeble pulse. In other cases of feebleness of function, with a hot skin and febricula, the cool or temperate bath does good service.

When, again, we wish to excite the skin to free secretion, by converting sensible into insensible perspiration, and to stimulate, also, a languid circulation and organism generally, as in chronic rheumatism and atonic gout, anemia and chlorosis, not complicated with inflammation of an organ, scaly diseases of the skin, of long standing, atonic dropsy, simple paralysis without evident cerebral lesion, and indolent glandular and other swellings, the hot bath, from 100° to 120° F., and the hot douche will be found to aid powerfully the stimulating and alterative effects of sulphureous waters.

Differences in the temperature and duration of the bath will grow out of the properties of the mineral waters employed for the purpose. Sulphureous waters, for instance, excite the skin and system generally more than others.

Division of Baths.—As there is still a too general ignorance of the actual temperatures of the received divisions of baths—cold, warm and hot, in which not a few medical men participate, it cannot be deemed amiss to introduce here the table which will be found, also, in my work already referred to.*

1. The cold bath	from 33° to 60° F.
2. The cool bath	60° to 70°
3. The temperate bath	75° to 85°
4. The tepid bath	85° to 92°
5. The warm bath	92° to 98°
6. The hot bath	98° to 112°

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* Baths and the Watery Regimen.

The only upward limit of the hot bath, is that of tolerance by the living body immersed in it. As regards the effects, in a general way, of these several kinds of baths, we may speak of them under two divisions, therapeutically considered. In the first, from warm down to cold, we shall find a calming and soothing operation continued, with the reduced temperature of the water, to the most depressing sedative—in fact a reducing power; and in the second from the upper degree of warmth, a stimulating and strongly exciting operation. What a mischievous error, therefore, is the too common one of confounding a warm with a hot bath, and directing the one for the other, as if they were convertible terms expressing the same thing, instead of being in direct contrast with each other. It may serve to indicate the striking difference between the warm bath and the hot bath, when I say that the first is a grateful hygienic agent which almost every body can make use of with benefit, in addition to its employment as a therapeutical one in the treatment of disease; whereas the hot bath is, or ought to be, a remedial agent to be used solely in disease, and even then with considerable caution and discernment. I shall have something further to say on this subject when speaking of the thermal springs of Virginia.*

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* There is yet one point connected with sanitary arrangements and the accommodations of visitors which requires reform, viz: that relating to water-closets and analogous cabinets, which are placed so often at most inconvenient distances from the main house, and which are very defective on the score of ventilation and cleanliness. A hint might be taken from the arrangements in these matters at the celebrated Baden-Baden Springs.

CHAPTER III.

First effects of drinking mineral waters—Secondary and remote effects—Diseases in which they are employed—Five classes mentioned by a committee of the French Academy on the subject—Comparative results in different diseases—Two great classes of invalids—The plethoric in the first—Sufferers from fever, disorders of the digestive apparatus, direct and secondary, bronchial disorders, rheumatism, nervous and skin and uterine diseases in the second class.

FIRST EFFECTS OF DRINKING MINERAL WATERS.

It is not at all uncommon for persons, after drinking a mineral water or using a warm, and still more, a hot bath for a few days, to complain of fulness of the head, or headache, lassitude, disordered digestion, with white tongue and some degree of fever, accompanied by eruptions on the skin. This is a state which the German writers call "Bath Storm," or "Crisis," and others "Saturation." It will generally disappear by increased discharges from the bowels, or by a copious sweat, sometimes by diuresis: it is regarded by these writers as salutary, and by not a few as an evidence of the curative powers exerted by the mineral or balneatory medication. Looking at mineral waters as, with few exceptions, exciting in their first effects, we must be prepared for some disturbance of the kind just described, and either suspend for a while the use of the water, or greatly diminish its quantity, or even dilute it by the addition of common water; or, as is done in some parts of the continent of Europe, add to it whey or simple mucilaginous drinks. Precautions of this nature are most necessary in the case of sulphureous and chalybeate waters. The simpler plan will be, to abstain for two or three days from the use of the water, and not to be too eager to remove the artificial, feverish, or other disturbance by very active or decidedly reducing treatment; but rather minister to these cases as we would to one which might occur at the conclusion of an ordinary fever. Reduced diet, diluent and demulcent drinks, and a moderately warm bath of 92° F. will commonly suffice.

In reference to the *secondary* and *remote*, and avowedly salutary effects of mineral waters, when we reflect on the large mucous surface of the entire digestive canal, to every portion of which they are applied and by which they are freely absorbed, thus reaching all the tissues of the animal frame; and bearing in mind, also, the number and variety, and often potency of the ingredients which enter into their composition, we are prepared to echo the language of a French writer* on the subject, when he says: "In general, mineral waters revive the languishing circulation, give a new direction to the vital energies, reestablish the perspiratory action of the skin, bring back to their physiological type the vitiated or suppressed secretions, provoke salutary evacuations, either by urine or stool, or by transpiration: they bring about an intimate transmutation, a profound change in the organism; they saturate the sick body, to make use of the energetic expression of a modern author. How many persons, abandoned by their physicians, have found health at mineral springs! How many individuals, exhausted by violent diseases, have recovered, by a journey to mineral springs, their tone, ready movements and energy, to restore which, attempts in other ways might have been made with less certainty of success!"

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* Pateissier, Sur les Eaux Minerales.

DISEASES IN WHICH RECOURSE IS HAD TO MINERAL WATERS.

These are almost as numerous as the entire nosological series of the chronic kind; but the number for which reasonable hopes of cure can be entertained, is comparatively limited, or rather the classes of diseases are not many. They consist of those of the digestive system, in themselves, however, a host; of the cutaneous and fibrous systems; and of the glands, secretory and lymphatic; and finally of the nervous system. Under the first head comes dyspepsia, with its multifarious features and sympathies, including affections of the throat, and gastric, duodenal and colonic dyspepsia, then enteralgia and chronic diarrhœa and dysentery, constipation, and hemorrhoids. Under the second head we meet with a great variety of chronic eruptions, some of them associated with and representing antecedent diseases, such as syphilis, scrofula, scurvy, &c. The fibrous system exhibits rheumatism and gout, as their immediate seat; but its lesions are intimately associated, in these diseases, with derangements and often violent disturbances of the digestive system, heart, and brain. The great glands auxiliary to digestion, the liver and pancreas, and that physiological puzzle, the spleen, particularly the first and third mentioned organs, are often the seats of congestion and inflammation, which, when they have run into a chronic form, are much benefited by certain mineral waters. Another great gland as it is sometimes viewed, the uterus, which makes the chief sexual distinction, is often disturbed and chronically diseased, and requires for its relief the combined operation of bathing and the drinking of mineral waters. The diseases of the lymphatic glands, so prominent in scrofula, are rather effects of a pre-existing condition of other parts, as those of the mesentery are of enteric disease, than primary maladies. They belong, also, to the morbid development of the scrofulous diathesis. Diseases of the nervous system occupy a prominent place in nosology, in which they are placed more with reference to certain symptoms, effects merely, than to their organic seat, or the organic lesions which give rise to them. The two opposite conditions of morbid sensibility and mobility, with irregular spasmodic and convulsive movements, and of anæsthesia and paralysis, are both of them deemed fitting subjects for the use of mineral waters, and of bathing; for, to insure success on such occasions, both of these therapeutical agencies ought to be enlisted, but, of course, with differences in the composition of the waters and the temperature of the bath.

In what is rather vaguely termed anemia or anemic condition of the system, depending, as is believed, on a deficiency of red globules of the blood, although it may be preceded by local inflammation, and be associated with plethora, mineral waters particularly of the chalybeate class, have acquired great reputation. The same may be said of chlorosis, which is characterized by similar derangements of function, in addition to the one which makes it more peculiarly a disease of women.

In a report on the subject, made by a committee of the French Academy, for the years 1833, 1834, and 1835, we are told that the diseases, for the benefit of which invalids resort to mineral springs in France, are few in number. They are, first, rheumatism in all its forms, the subjects of which make up nearly a third of the entire number of invalid visitors. At some springs they are in the proportion of half, in others two-thirds of this class. The next are the nervous or nervous derangements, augmented sensibility, with, often, spasm of the digestive and other systems. On the third line are chronic inflammations of the mucous and serous systems, a large class, comprehending those of the digestive and respiratory apparatus, and of the uterine and urinary organs, and neuralgias. At some springs, paralyses and diseases of the skin, constituting, as it were, a specialty, present themselves; after which come old wounds, false anchyloses, and lymphatic engorgements. Beyond these five classes we only meet, the committee alleges, with a few other cases of disease at mineral springs.

The data on which these divisions and proportions are made are furnished by the annual returns of the medical inspectors—resident physicians—at a great number of watering places in France. From the same quarters we learn the relative efficacy of the waters in the different diseases of those who made use of them. They are represented to be *quite certain* in rheumatism, *tolerably sure* for neuralgias and neuroses, *nearly null* for paralysis, and *not unfrequently useful* for affections of the skin and joints. But there must be some fallacy in this show of calculation, for we cannot suppose chronic rheumatism to be cured with the frequency that is alleged by some physicians at the springs; and our doubts are strengthened by the fact of the repeated visits, annually, of the same persons to the same springs with their old disease.

In appealing to the experience of continental Europe for the effects of mineral waters, we must, however, bear constantly in mind the fact, that the treatment at most of the springs consists both in drinking the waters and in bathing. Often, especially in Germany, the greatest and sometimes sole stress is laid on the latter kind of medication. In the United States, there are few attempts made at any methodical combination of these two means of cure; the bath being used only on occasions, irregularly, and most of the time according to the caprices of the patient. It is very desirable that physicians should take some pains to inform themselves of the value and systematic method of using the bath at various temperatures, and not allow the impression to go abroad that the community must look to hydropathists and steam doctors for the desired therapeutical aids obtainable from this source.

We may, it seems to me, divide into two great classes the invalids who resort to mineral springs in the United States for the relief or cure of their diseases. They are, first, those who labor under plethora or preternatural fulness of the bloodvessels, and particularly of the veins, with determination and accumulation of blood in one or more organs, keeping them in a critical state of distension, and liability, at any moment, either from the extreme effects of common hygienic causes, or from morbific ones, to run into congestion and inflammation, or rupture of bloodvessels, in the early and more acute stage of disease, and into congestion with effusion of serum, in the subacute and chronic stage. Often, with plethora, is associated activity of the assimilating and nutritive functions, and large deposits of fat in particular regions. But this last is not so much an evidence of health as a means by which the bloodvessels relieve themselves, through the assistance of the secretions in the tissues, of superabundant material, the retention of which would be perilous, if not fatal, to the organism. This large deposition of oily matter or adeps is, in fact, a variety of dropsy, a disease of itself, but which serves to ward off more disastrous results. Apoplexy, some forms of asthma and oppression of breathing, irregular action of the heart, congested liver, and piles, are other more fatal or distressing manifestations of the state of plethora. Rheumatism and gout, in their early stages and more acute forms, are the results of an effort of nature to relieve the excessive fulness and plethora of the internal, especially the digestive and assimilating organs, by determination to external parts. Certain inflammatory eruptions on the skin, such as boils and other pustular affections, are efforts of a similar kind.

No better means of relief can be offered in plethora, with its various manifestations and threatenings, as now sketched, than the employment of mineral waters of the saline aperient class, with the addition of carbonic acid, and a slight chalybeate impregnation, which excite copious secretions from the intestinal canal, without irritation, and without weakening, while at the same time they diminish the undue amount of blood, and carry off redundant humors. It would be taking quite too limited a view of the operation of these waters to suppose that they merely act as purgatives, by emptying the bowels of accumulations in them. They are also depuratives and deobstruents, and produce critical evacuations from the entire mucous surface, thus relieving congestions of the mucous membrane, and of the liver and other abdominal organs, by an augmented activity of physiological action, rather than by irritating and disturbing, as common drastic purgatives do. The first are retained and absorbed, and increase the appetite and strength; the second, as foreign and irritating substances, are expelled with pain and effort, as would be deleterious substances.

We must suppose, however, that the benign operation of the waters is aided by an amended regimen, and a change in the habits of the plethoric and of those predisposed to or suffering from some one or more of the disorders above mentioned. These persons are found, in considerable proportion, among the luxurious and over-fed, who have slept too much and exercised too little. The most common variety of plethora is the abdominal, on which the German physicians lay so much stress, and to which they refer a long list of derangements of the digestive and uterine systems, and, finally, nervous disorders. There may be seen among ourselves counterparts of the "fat abdominous and middle aged Germans, who live sensual, sedentary lives, eating and drinking gluttonously, and smoking incessantly," who, like the latter, must find relief by throwing off, with the aid of mineral waters, "the perilous stuff" which oppresses them.

The second and largest class of invalids who visit mineral springs and other watering places, suffer from the remains of fever, diseases of the digestive canal and its appendages, bronchial and laryngeal irritations, and coughs of long duration, rheumatism, irregular gout, and nervous disorders; sometimes paralysis, and often cutaneous eruptions. In this class are females affected with derangements of the uterine system, in addition to their share of the other maladies on the list. Were we to seek for the chief seat and centre of the diseases above mentioned, we should undoubtedly find it in the digestive apparatus, and especially the alimentary canal, which is made to suffer so much and so long by a daily, and often thrice repeated in the day, load of heterogeneous articles of food and drink, and which, in consequence, spreads by sympathetic radiation, its uneasiness and disorders to nearly all parts of the living frame. What with much eating and fast eating of gross food, and drinking of spirituous and other liquors, and smoking and chewing of tobacco, not to speak of drinking coffee in any quantity, the digestive organs of our people are sorely tried in a direct manner, while, indirectly or reflectedly, they are made to suffer by inattention to the functions of the skin, which has so close a sympathy with the stomach and bowels, and, most of all, by the continued excitement and strain to which the brain and senses are exposed in the eager, unceasing, and anxious struggle for wealth, and the ambitious longings for political distinction and office. The life of toil, and the feverish, almost insane, thirst for gold at "the diggings" and in the mines, meet with their counterparts, under other names and with different manifestations, nearer home.

We cannot wonder, with a knowledge of these causes, in which we must include a most variable climate, or rather contrasted climates in the same region, that congestion and irritation of the digestive mucous membranes should be so common, and be exhibited under such a variety of symptoms, which are grouped under the names of different diseases; and that inflammation itself, in a chronic form, should be far from uncommon. The portal circulation is retarded, and secretions from the liver are scanty and imperfect. With imperfect digestion there must be also imperfect sanguification. The complexion is pale or sallow, or of a brown or an ashy hue; sometimes the skin is suffused with bile. The kidneys perform their functions imperfectly, and according to the predominance of the diathesis, the urine shows either lithic acid, or phosphate of lime and magnesia, deposits. Sometimes constipation, sometimes diarrhœa is present; and gastric or intestinal neuralgia, and colic, with the passage of biliary calculi, torment the invalid. A foul and dry, or a loaded pasty tongue, nausea and vomiting even, indicate the disordered state of the stomach, which is oppressed, and often thrown into spasmodic contractions by food, which in a healthy state of the organ would have been easily digested. In females, the uterine functions are deranged; menstruation is irregular or suspended, and leucorrhœa adds to the feeling of exhaustion, while chlorosis completes the sombre picture of languor, apathy, and discouragement. The complexion in this last disease is emblematic of the frame of mind, and the spirits of the invalid herself. The brain, which may at first have sent by its nerve-conductors to the stomach, annoying and disturbing messages of its functional fretting, and cares, and vigils, and wild transports of joy or anger, receives back, by similar means, with large interest, from the fatigued, and worried, and irritated, and, it may be, inflamed stomach, a crowd of unexpected and abnormal impressions, which become the sources of strange sensations and imaginings, as we see pictured in hypochondriasis and hysteria, and of strange movements, as in chorea, epilepsy, and in other ways; also in headache, vertigo, ringing in the ears, want of sleep, low spirits, languor, and disinclination, and still more, inability to take much exercise.

This simplified pathology, which teaches us to regard so many seemingly different diseases as radiations from a common centre, allows us to recommend, without incurring the charge of empiricism, a class of remedies, such as we find in mineral waters, whose operation, first and mainly manifested at the centre or the digestive system, is subsequently diffused through the entire organism. By causing copious secretions from the extended mucous surfaces, they relieve the congestion of the mucous membranes, restore the proper activity of the portal circulation, and amend the biliary secretions; and while renovating the digestive organs, enable them to form good blood, which gives color and animation to the previously adust complexion, and depressed countenance, and which, when transmitted to the brain, and the muscles, and the uterus, imparts to these organs new life and activity in the discharge of their several functions. The brain, moreover, being no longer teazed by irritations transmitted from the stomach, allows the mind to recover its calm, and even to manifest cheerfulness, if not hilarity, at the consciousness of the removal of a heavy load and of distressing pains.

These successive stages of recovered health are not gone through with the aid of one kind of mineral water alone; for, although the beginning is most satisfactorily made by the saline aperient class of these waters, the continuation is often advantageously carried on by the chalybeate, or the sulphureous, with the judicious interposition, at times, of the acidulous. Thus we are enabled to carry out the evacuating, the tonic, the stimulating, and the alterative parts of the curative course. The selection and alternation of waters to be drunk, and the quantity to be used at one time, will necessarily depend on the predominance of disorder in a particular organ, and the nature and extent of the sympathetic disturbance to which it gives rise in the general system, circumstances these which must, in a great degree, be ascertained by intelligent physicians resident at the place, or whose stay and frequent prior visits have given them the requisite opportunities to form correct opinions of the effects of the waters.

CHAPTER IV.

Mineral springs of New York—Their geological relations —Acidulo-saline waters—Those of Saratoga and Ballston—Their situation and extensive range—Chief springs at Saratoga—Physical properties and analyses of the waters.

In the following pages, my notice of the several mineral and thermal springs of the United States will be in geographical order; as more convenient for the visitors to these places, although it will cause some repetitions of opinions and experience respecting the curative powers of springs of similiar composition in different states. I begin with the springs of New York, as the most northerly of the states of which we possess anything like a detailed description.

The geological situation of a considerable number of the gaseous springs in New York, is represented by Professor Mather* to be on or near the junction of limestone with a talcy slate, which is considered as an altered rock, and both these rocks may, in many places, be considered metamorphic. They are all adjacent to faults in the strata, or where the rocks are much deranged in position. Some of these springs are thermal, and perhaps all of them would prove to be so by a careful measurement of their temperatures. Some of them deposit tufa, but most of them are as pure as common spring water, and are employed for domestic purposes.

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* This writer would seem to designate as gaseous springs those the waters of which contain or evolve

The range of springs, as far as has been observed, in the eastern part of the state of New York, is from near the Vermont line, in the township of Hosick, Rensselaer County, by Lebanon Springs, to near Stony Point, in Rockland County. Those of Vir-

nitrogen and carburetted hydrogen gases. Dr. Lewis C. Beck speaks of "Gas Springs," or Carburetted Hydrogen Springs, as equivalent terms. Both these gentlemen, by this nomenclature, restrain within entirely too narrow a compass, the division of gas or gaseous springs, Both carburetted hydrogen and nitrogen springs are merely subdivisions or varieties of the class, if we can really make one of gas springs.

ginia, and perhaps intermediate ones, may be considered as on the same great axis of disturbance. It is probable, continues Mr. Mather, that observers may find similar springs in Vermont, Massachusetts, and New York, along the continuation of this line of disturbance. The thermal springs of Virginia, as we shall soon see, have nearly the same geological relations with those of New York, and are on the same, or a parallel axis of upheaving action.

New York is rich in mineral springs, especially those of the sulphureous class. The acidulous, although in smaller number, furnish, however, some which are more celebrated, more visited, and endowed with more medicinal virtues than any other, not only in the state, but in the United States. I refer, of course, to those of Saratoga, a spot endeared by its historical associations to every American. Ballston, a few miles distant, was at one time the place most visited by invalids and summer travellers; but for several years past it has been, in a great measure, neglected. Alone, or situated in another part of the country, such is the mineral strength of its waters, it could not fail to attract much company.

SARATOGA AND BALLSTON SPRINGS.

These waters are appropriately enough called acidulous, from the abundance of carbonic acid and of carbonates which they contain; and, owing to their large impregnation with chloride of sodium or common salt, they are also actively saline, and hence their proper designation must be *acidulo-saline* or *carbonated saline.* These springs, we are told by Dr. Steel,* are all situated just along the verge of the secondary, and not far from the transition formation. Those of Saratoga seem to form the centre of a long range in the shape of a crescent, commencing at Ballston lake, about eleven miles to the southwest, and terminating at the Quaker Springs, at Stillwater, to the southeast. At Saratoga, they are more numerous and diversified in their sensible qualities, than at any other place; but it may be said that, with few exceptions, all the mineral springs in the crescent just mentioned appear to possess the same qualities, and differ only in the proportion of substances common to all. It would seem, therefore, as if they received their distinctive properties in one vast laboratory; some of them being modified, in their passage to the surface, by the geological character of the upper stratum through which they passed.

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* Analysis of the Mineral Waters of Saratoga and Ballston, &c.

If we admit the correctness of Dr. Daubeny's observation, that the temperature of the water of the Congress Spring, at Saratoga, 51° F., is three or four degrees above the mean temperature of the earth at this place, we can give credence to the opinion of the thermal origin of the water, and of the mode of extrication of the carbonic acid so largely found; it being brought about by subterranean heat acting on limestone rocks. The first process would consist of the junction of carbonic acid, coming through clefts and small canals, with the meteoric water which had reached its greatest depth and was beginning to rise in larger canals. The second process would be the decomposition and solution of portions of certain rocks, and the formation of acidulous springs, rich in carbonic acid and carbonates. The same heat which would drive off carbonic acid from limestone, would readily raise the temperature of the meteoric water which finds its way into the interior of the earth, and we should then have thermal—warm and hot springs. Reasoning in this way, we can easily adopt the views of those who maintain that carbonated and thermal springs are similar in their mineral, and still more in their geological position, and seem to be plainly referable to the same system of causes.

The separate formation of carbonic acid is evinced in the fact of its evolution in its pure gaseous state in caverns and from crevices in certain districts, unaccompanied by water, but in which, for the most part, there are, also, copious carbonated or acidulous springs. Examples of this nature are frequent; as in the *vapor caverns* of Pyrmont, mentioned by Bischof. This writer tells us, also, of a mineral spring entirely destitute of carbonic acid opening on the bank of a rivulet, although the abundant deposition of iron ochre shows that the spring must have contained a considerable quantity of gas, and, in fact, we have not far to seek for it. At the distance of a few hundred feet higher up, and at a level of twenty feet above the spring, there is a cavity so filled with carbonic acid, that it is only at the risk of losing his life that one dares to venture into it.* Here we must believe that the gas originally mingled with the water of the spring, and, by the removal of the hydrostatic pressure from this latter as it approached the surface, escaped by another channel. Often the carbonic acid escapes through the water itself, in such a manner and at intervals as to show its separate and independent origin. Thus, at the Park Spring (Ballston), as we learn from Dr. Lewis C. Beck,† "minute bubbles of gas are continually rising through the water; but at an interval of about a minute, the whole will be agitated by the evolution of a comparatively large bulk of the gas. This gas, which is in all cases nearly pure carbonic acid, also rises in great abundance through the water of a well near Low's Spring, and in various places in the valley of the stream. Some years since, there was a very remarkable and, indeed, almost volcanic discharge of it near the old factory, which threw up the water of the creek several feet into the air; but the gas soon diminished greatly in quantity, and can now be observed rising only in small bubbles through the bed of the stream."

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* Subterraneous Course of Water, and the Absorption of Gases by Water in the Interior of the Earth.—Edin. Phil. Journ., vol. xviii.

† Mineralogy of New York, p. 137.

When the gas meets the water in the lowest part of the hydrostatic pressure, and when the canals of water proceed downwards to a great depth in the earth, these various relations are favorable to the entire absorption of the gas. When, on the other hand, the gas enters the canal nearer the surface of the earth, it may easily happen that only a part shall be absorbed, while the larger portion passes freely through the water. In this case, we are led to believe that the absorption of the carbonic acid by water takes place near the surface. Bischof calculates that at the springs of Meinberg, in Lippe-Detmold, the gas joins the water canals at a depth of about fifty feet below the surface. Mr. Mather suggests that the mineral qualities of the Ballston waters originate at the contact of the slate with the Trenton limestone, which he thinks is not more than fifty feet below the level of the valley. The size of the bubbles is, Bischof thinks, regulated by the nature of the ground. If the spring comes from larger clefts in the mountain, the bubbles are large; but if from many small openings of a porous rock, the supplies are often not larger than the gas beads of champagne.

The Saratoga Springs are mostly situated in a low, marshy valley, near a ridge of limestone, and rise from a bed of blue marly clay that underlies the valley and the sand plains in the vicinity. The water sometimes rises from the clay, sometimes from the underlying limestone, and sometimes from a layer of quicksand. At the depth of thirty or forty feet, the stratum is underlaid by a system of boulders.*

The water of the Ballston Springs rises from a bed of quicksand, beneath the bed of clay filled with pebbles, boulders, and gravel, and which is commonly called "hand pan." The sand bed is supposed to rest in the fucoidal or graptolitic slate (and this slate is seen in place at a very short distance). The mineral water rising through a bed of quicksand, carries much of this sand along with it, and this is impacted so tightly in the tubes as to obstruct the free flow, and frequently causes it to break out elsewhere. The springs are thus lost, and in other cases springs of fresh water frequently break into the wells, and dilute the mineral qualities of the water. A well was dug at Ballston Spa, near the creek, during the spring or winter of 1840, and after digging thirty or forty feet, there burst up a current of water from the bottom of the well, which gave a stream sufficient to drive a mill. The water was slightly acidulous, and seemed to be a mixture of the mineral water of this vicinity with fresh unimpregnated water. "Should it be advisable to bore for water at Ballston Spa," continues Professor Mather, "I would advise the boring to be carried even into the calciferous sandstone, if water should not be obtained before, for the source of the mineral qualities may be deeper than the junction of Trenton limestone with the slate."

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* Mather—Geology of the State of New York. Part 1.

It has been already remarked that the groups of springs at Saratoga and Ballston possess very nearly the same properties; the difference consisting in the proportion of the saline and gaseous ingredients. In and near Saratoga are found the several springs known by the titles of Congress, Pavilion, Union, Putnam, Iodine, High Rock, Flat Rock, Hamilton, Columbian, and Washington. Of these, a preference has been given for some time past to the one first mentioned; fashion directing the choice as much as any demonstrable superiority in its favor.

Congress Spring.—Subjoined are the analyses of this water, a *pint* being the quantity on which the proportions are based. They were made by Professor Dana and Doctor Steel, and are reproduced here as we find them in Dr. Lewis C. Beck's "Mineralogy of New York."

The temperature of the water is stated by Dr. Steel to be 50°, and by Dr. Daubeny 51° F. It remains the same at all seasons, nor is the quantity of the water changed at these periods.

	Grains.	Grains.
Chloride of sodium	54.30	48.13
Hydriodate of soda		0.44
Carbonate of soda	2.00	
Bicarbonate of soda		1.12
Carbonate of magnesia	4.00	
Bicarbonate of magnesia		11.97
Carbonate of lime	18.00	12.26
Carbonate of iron		0.63
Silica	trace with iron	0.19
Hydrobromate of potassa		trace.
	78.30	74.74
	Cubic Inches.	Cubic Inches.
Carbonic acid gas	39.10	39.00
Azote, or nitrogen	0.90	
Atmospheric air		0.87
Gaseous contents	40.00	39.87

Dr. Chilton's analysis, as given by Dr. North,* differs from the above in its exhibiting a minute or fractional quantity of alumina and sulphate of soda, and marked proportions of iodide of sodium and bromide of potassium, viz: 5.920 grains in a gallon of the water. The entire amount of solid contents was 543.998 grains, and of carbonic acid 284.65, and atmospheric air 5.41 = 290.06 cubic inches.

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* Analysis of Saratoga waters; also of Sharon, Avon, Virginia, White Sulphur, &c.

Pavilion Spring.—The water of this spring, with a smaller quantity of saline contents—311.71 grains in the gallon—than that of the Congress, exceeds this latter in the proportion of carbonic acid, which is 359.5 cubic inches. The Pavilion Spring is now in the centre of the town, near the Columbian Hotel.

Union Spring.—This spring, at the eastern border of the town, near the road to Schuylerville, was represented by Dr. Beck to contain a larger proportion of saline ingredients than any of the preceding ones. The assertion has not been borne out by the analysis of Dr. Chilton, which gives 392.907 grains of solid contents in a gallon of the water. The carbonic acid is in somewhat less proportion than in the Pavilion, and considerably more than in the Congress water, being 344.16 cubic inches in a gallon of the water.

Putnam Spring.—This, called after its owner, ranks among the richest of the springs of Saratoga, on the score of chalybeate impregnation, containing as it does 7 grains of the carbonate of iron in the gallon, in addition to the ingredients common to it and the other springs.

The Iodine or *Walton Spring*.—The water of this spring contains, according to an analysis of Professor Emmons, in addition to the other ingredients, hydriodate of soda, in the proportion of 3.5 grains to the gallon of water. Its chalybeate impregnation is greater than that of the Congress water, but less than that of the Pavilion, Union, and others. Temperature 47° F.

The High Rock, Flat Rock, Washington, Hamilton, and Columbian Springs, analyses of which are given by Dr. Steel, resemble each other, and those already described, with the modified feature of being actively chalybeate.

The High Rock Spring is surrounded by a conical rock of calcareous tufa, formed by deposits from the water itself; its diameter, at its base, is between eight and nine feet, and at its summit, between five and six. The somewhat singular appearance of this fountain first introduced it into notice; and, as we are told by Dr. Steel, it remained, for a time, the only one in use, when much was said by the credulous of its *astonishing effects* in the cure of nearly all diseases. Temperature 48° F., the same as that of the Flat Rock Spring.

The High Rock was the spring first discovered, or rather the first to which the attention of the then colonists was directed by the Indians, in whose traditions it had long been celebrated for its medicinal virtues, especially for the cure of rheumatism. They were first drawn to the spot by the great quantity of game that frequented it as a salt-lick. The first white visitor was Sir William Johnson, in 1767, who was very subject to gout, and whose health was improved by the use of the water. About the year 1784 and 1785, accommodations were provided for a few invalids, and about this time the Flat Rock, the President, and the Red Springs were discovered.

Dr. Steel, to whom I am indebted for this historical notice, describes in addition to those already mentioned, the Hamilton, Red Spring, Jackson, Alexander, Ellis's, and Sulphur Springs. The Red Spring derives its name from the deposit of iron ochre, which colors the fine sand that is readily mixed with the water on its being agitated. Its temperature is 48° F. That of the President is 51° F., of Jackson 50°, the same as the Columbian, Ellis's 47°, Alexander 48°, Hamilton the same. The temperature of the Sulphur Spring is 50°, while that of a fountain of pure water close by, or within ten feet, and which rises from the same bank, is at 46°, and this last is, we believe, higher than the average of the common springs of this district, so that all the mineral springs of the valley may be considered as, to a certain extent, thermal.

Ballston Springs.—This town is about seven miles southwest of Saratoga. The springs are mostly situated in a marshy spot, at the bottom of the deep valley of the stream Kayaderosseras. The bed of the stream is slate, although it cannot be asserted that the carbonated waters have their origin in this rock. The springs at Ballston were discovered about the year 1787, and owing to their advantageous position, and to the enterprise manifested by the proprietors of the lands on which they were situated, in erecting good houses of accommodation, and making other improvements, this place took the lead of Saratoga for the next fifteen or eighteen years. Since then, thanks to Mr. Putnam's exertions in erecting a large house for the accommodation of visitors, near the Congress Spring, Saratoga has rapidly acquired a celebrity which promises to be as permanent as it is now widely diffused.

The situation of Ballston is represented to be pleasant and healthy, and the air "extremely clear and cool;" a praise, on the score of coolness, which cannot be awarded to Saratoga, much as we may admire the general healthiness of the place.

Of the different springs at Ballston, mention may be made of the *United States*, the *Fulton Chalybeate*, the *Franklin Sulphur*, and *Park*, and *Low's Well.*

The *United States Spring* is highly charged with carbonic acid, while the others contain only a small proportion of this gas. The temperature of this spring is 50° F., which does not seem to vary during the year. Specific gravity of the water 1.00611. According to an analysis made by Dr. Beck, one pint of the water contains

	Grains.
Chloride of sodium	53.12
Carbonate of soda	2.11
Carbonate of magnesia	0.72
Carbonate of lime with a little oxide of iron	3.65
Sulphate of soda	0.22
Silica	1.00
	60.82

Carbonic acid 30.50 cubic inches.

It will be seen that the Congress water at Saratoga contains from 13.50 to 17.50 grains of saline substances, and between 9 and 10 cubic inches of gas more than this water, in equal quantity.

Low's Well resembles the preceding in its ingredients, but its water contains less saline matter. Its specific gravity is 1.02548. Temperature 50°.

Park Spring at the rear of the Village Hotel has, also, nearly the same composition, "but the oxide of iron is in much larger proportion than in any of the waters of the vicinity."

CHAPTER V.

Medicinal employment of the Saratoga waters—In congestive states of the digestive system, and plethora—Sympathetic disturbances—Quantity of the water drank—Time of drinking it—First or purgative operation—Second or alterative.

Medicinal Employment of the Saratoga Waters.—The diseases in which the aperient saline waters of Saratoga are serviceable may be included in the sketch already given of those which proceed from, or are associated with, a congestive state of the digestive system, and with abdominal plethora. The feeling of load and oppression in the abdomen, sometimes resulting from undue retention of food in the stomach, sometimes from enlarged liver or spleen, sometimes from fecal accumulation in the large intestine, and again from flatus and distension in different parts of the canal, often from sluggish circulation of the portal system, all of which derangements of function may manifest themselves at the same time, will be relieved in the same way, viz: by free secretory action of the mucous membranes of the intestinal canal, procured by the purging springs of Saratoga, such as the Congress water. The disorders of the abdominal viscera here noticed, pass by the various names of dyspepsia, liver disease, bilious complaints, costiveness, piles, &c. They are associated with, or give rise to, very different degrees of excitement of the heart and circulation generally, and of disturbance of the nervous system, according to the susceptibility of the individual. Some invalids suffer from febrile excitement, exhibited by a frequent pulse, a dry and hot skin, and thirst; others from nervous disorders, pain, cramps and spasm; the pulse being little changed, and the skin cool or moist and clammy. The physician will not allow his attention to be diverted by the variety of these secondary or symptomatic disorders from the main, central, and primary one, nor fail to see the necessity of directing his treatment for the removal of the abdominal congestion.

When it is ascertained that there is no existing inflammation or febrile excitement requiring more decidedly and promptly depleting and reducing means than those furnished by the Congress water, or others of a similar character on the spot, recourse will be had to them, and their use continued in a methodical manner. To meet the indications already laid down, they must be administered in such quantities as to produce copious and repeated evacuations from the bowels daily, for a period of at least two weeks. Failing to act at first as an aperient, in the ordinary quantities, they should be reinforced by the addition of a drachm or so of Epsom salts, and of half the quantity of common salt, dissolved in the first tumbler of the mineral water; for, in the beginning of a course of drinking the Saratoga water, there can be no compromise or half-way results. There must be free purging if we wish for the best immediate effects; and, also, if we desire to put the digestive system and the economy generally, in such a condition that it will be still more benefited and strengthened by a subsequent alterative treatment from the use of the water in small quantity, or by a tonic course from drinking other waters, in which the iron is more abundant, or into the composition of which iodine enters.

The quantity of the water drank to produce the desired aperient effect, is from one to three pints, early in the morning, in draughts of half a pint, at intervals of from five to ten minutes; the invalid walking about or taking other exercise during the whole period. If unable to go to the spring, he should pace up and down a piazza or long corridor, and might use dumb bells at the same time. An hour at least ought to elapse between drinking the last draught of the water and breakfasting. Confinement to his room will not, however, preclude the invalid from drinking the water in the manner now mentioned; but it will be desirable that he should begin at quite an early hour, and allow a still longer period to elapse between his last glassful and breakfast than if he had gone to the spring.

While thus laying so much and such deserved stress on the purgative action of the Saratoga waters, we must not suppose that their good effects, at the very time, are all obtained in this way. Reference has been already made to the copious secretion from the kidneys, caused by this class of waters. As they are largely absorbed and enter the bloodvessels, they cannot fail to reach every tissue, and modify every secreting process in the living body, while they are exerting their chief activity on the intestinal mucous membranes and its secretory glands. The liver, and the pancreas, and the salivary and muciparous glands, and the pelvic viscera, must all of them be impregnated by this diffusive medication; nor will the skin escape the influence of this cause, as we soon see by its greater softness and suppleness, and improved color. In fact, the alterative process is going on contemporaneously with the purgative, as evinced not only by the improvement in the assimilating functions, but also in those of the nervous and muscular systems. The invalid is in better spirits, looks on the world with a more cheerful and kindly feeling, and is both willing and able to walk abroad, and to indulge in active exercises, if not sports.

All these pleasant results are not, we may well suppose, gained in the first two weeks' drinking of the Congress or other similar water at Saratoga; but approaches are made, and a consciousness is felt that much good is to follow. It will be proper to suspend, after that period, the use of the water for a few days, so as to allow time for the functions to resume, as near as may be, their physiological action, and thus enable the physician to measure the actual results of the course which has just been gone through. He can then, according to the state of the invalid, either congratulate him on his rapid progress towards a cure, or, seeing that there is real amendment, but still some remaining disease, counsel a renewal of the treatment. This will consist in resuming the use of the water in purgative doses, or in smaller quantity, in order to produce more entirely its alterative and in degree tonic effect. If the latter course is determined on, the water will still be taken in the morning in preference to any other time, in a dose of half a pint; and if more be thought desirable, it may be repeated in the same quantity at noon, or an hour before dinner, and if this meal have been a light one, and eaten early in the afternoon, say at one or two o'clock, again in the evening before retiring to bed. Even smaller quantities, taken at these intervals of time, and continued for two or three weeks, will be found to exert a very salutary effect, especially in dyspepsia, chronic bowel disease, and irritation of the kidneys or bladder, scrofulous swellings, and chronic rheumatism. But, in order to derive full benefit from this course, it ought to be conjoined with the daily use of the tepid or the warm mineral bath: the first, if the skin is dry and warm; the second, if it is cold, and the pulse slow.

In many of the disorders already mentioned, the direct result of disease of the digestive organs, as well as in others of secondary occurrence, it will be well, after the purgative course is completed, to pass from the use of the Congress to the Iodine or some other spring, such as the Pavilion or Putnam's, in which there is a larger proportion of iron. More especially will this be desirable in those cases in which the invalids have suffered from periodical fever, hypochondriasis, hysteria, and anomalous pains in different parts, or from partial paralysis and chlorosis.

After suitable purging by the waters, which of itself gives great relief in chronic bronchitis, the alterative treatment, as described above, will contribute to carry off the disease, particularly in those cases, and they are frequent, in which the stomach is deranged in its functions at the same time. But it is not necessary that I should specify all the chronic diseases arising from perverted nutrition—tumors and deposits—or from chronic inflammation and thickening of tissues and ulcerations. The same rules will govern in the treatment as those already laid down. They may be summed up briefly in saying, that effects of an actively reducing kind are to be first produced by the waters, as purgatives, and of secondary and alterative ones by their longer use in smaller doses.

The sulphur springs within the village possess, we are told by Dr. North, but feeble sulphureous qualities. Abel's Spring, in the southeast border of Saratoga Lake, is richer in this particular; and as it can be visited twice daily, through the summer, by a line of omnibuses to the lake, and a fine steamer on the latter, its virtues cannot fail to be fully tested by a crowd of invalid visitors, some of whom have already spoken highly of its good effects used internally.

"There is still another sulphur spring about two miles west of Saratoga village, on the farm of Mr. Benedict, and near Rowley's stone mills. This water contains table salt, lime and iron, besides sulphuretted hydrogen and carbonic acid. It promises well for bathing, and has already done much for the cure of certain cutaneous affections."

The dry and bracing nature of the atmosphere of Saratoga, and "the highly balsamic or rather turpentine qualities with which it is impregnated by the numerous pine and other forest trees that have been allowed to remain in and around this beautiful village," are told with all due emphasis by Dr. North. There is room for improvement in opening out walks in different directions, with trees planted on either side, and in laying out a park on the hill above the Congress Spring.

Excursions, furnishing variety and amusement, are made to Saratoga Lake six miles south of the springs and the same distance from Ballston Spa, and to Long Lake, five miles from the latter spot. Saratoga Lake, which is nine miles long and three broad, is much resorted to for fishing, boating, and in quest of game. The less adventurous are satisfied with traversing the lake in its length by steamboat, and returning by the same means. At certain points picturesque views of the country around are met with, and at one spot a bold feature in the landscape offers in Snakehill, which projects into the lake near the southern end. Long Lake is five miles long and one broad. It abounds in fish.

Many persons visit Lake George from Saratoga. The first part of the route, for a distance of sixteen miles, is by railroad to Moreau, thence over a plank road for fourteen miles to Caldwell on the lake. Some stop at Glen's Falls, five miles from the railroad station, in order to enjoy the view of the fall of a body of water nine hundred feet wide, over a precipice of forty feet, with irregular angular interruptions, to the extent of several hundred feet. Caldwell, at the head of Lake George, is represented to be a very pleasant spot for spending a few days in the summer months.

Saratoga Lake discharges itself, by the medium of Fish Creek, into the Hudson River near the village of Schuylerville, formerly famous for its herring fishery. On the flat land, adjoining the river on the north side of Fish Creek, are still to be seen the remains of the fortified camp erected by General Burgoyne, in his retreat after the disastrous engagements at Stillwater and Saratoga. At this place he surrendered his whole army to the American forces under General Gates.

Travellers from the south and the east reach Saratoga by way of Albany and Troy, from both of which places, the former forty miles the latter thirty-two miles distant, they come on railroad by way of Schenectady. From Canada, Niagara, and the Lakes, the approach is made by means of the Albany, and Buffalo Railroad, through Schenectady. A railroad runs from Saratoga to Whitehall, making a connection with Lake Champlain.

Albany Artesian Mineral Wells.—This well was procured without the intention of the parties to whom we are indebted for its appearance above ground. The design of Messrs. Boyd and McCulloch was to obtain, by boring, pure water for the supply of their brewery. In the place of this there came bubbling up from the depth of four hundred and eighty feet, a saline water, rich in the carbonates and carbonic acid, and emitting at the same time carburetted hydrogen or burning gas. On boring to the depth of six hundred feet, the flow of carbonated water and of this gas continued. Afterwards, a tube was sunk to prevent the admixture of the latter with the mineral water. Similar results were obtained by boring, at the distance of a few rods from this spot, to the same depth, with the singular addition of the escape of sulphuretted hydrogen gas from a vein of water which was struck at about thirty feet from the surface. "We have then," continues Dr. Beck, "in the same slate formation, though at different depths, sulphuretted hydrogen, carburetted hydrogen, and carbonic acid gases, abundantly evolved."

These two wells were supplied from the same vein of water, as was shown in the fact that when the pump of the one in the "mineral garden" was put in operation, the level of the water in the other well was soon reduced, and it was at length rendered entirely valueless. Dr. Beck thinks that it would not be at all surprising if carbonated water were found, by boring, at any spot on the range from Albany to Saratoga.

The temperature of the Albany water is 51° to 52° F. Its specific gravity at the temperature of 60° F. is 1.00900. An analysis of one pint of the water, made by Dr. Beck, gave the following results:—

	Grains.
Chloride of sodium	59.00
Carbonate of soda	5.00
Carbonate of lime	4.00
Carbonate of magnesia	1.50
Carbonate of iron (with a little silica)	1.00
Chloride of calcium	0.50
	71.00

Gaseous contents, 28.00 cubic inches.

Dr. Mead,* in his analysis, makes the solid contents 75 grains, by his finding 4 grains more of the chloride of sodium, and 0.50 of carbonate of magnesia, than Dr. Beck, while he failed to detect chloride of calcium.

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* Am. Journ. of Science, xiii. 145.

This water is nearly as rich in saline contents as the Congress at Saratoga.

Reed's Mineral Spring, in South Argyle, near the Moses Kill, in Washington County, is another acidulous spring, somewhat resembling the Saratoga water, but containing less gas. Its taste is distinctly acidulous, but it does not sparkle.

Halleck's Spring, near the village of Hampton, in Oneida County, was opened by boring into a solid rock to the depth of a hundred and six feet. One pint, on analysis, by Professor Noyes, formerly of Hamilton College, showed the following constituents:—

	Grains.
Chloride of sodium	78.00
Chloride of calcium	13.00
Chloride of magnesia	4.00
Sulphate of lime	5.00
	100.00

"The spring evolves carburetted hydrogen in considerable quantities, together with a minute proportion of carbonic acid. The composition of the water is quite similar to that of the weak brine springs, to which it, perhaps, more properly belongs."

We have not heard, for some time past, of the spring in Clifton Street, in the city of New York, the water of which was said, when first procured, to resemble closely that of the Congress Spring. Its composition was found to be more complex than that of any other found in the State, but its solid contents in a pint are only 18.74 grains, and its gaseous proportions, carbonic acid and atmospheric air, 8.14 cubic inches.

CHALYBEATE SPRINGS.—A strong and copious chalybeate spring is found about a mile west of the village of Sandlake, in Rensselaer county. It issues from gravel.

Near Catskill, in Greene County, there is another strong chalybeate spring. Several of the same kind are found in the counties of Dutchess, Columbia, and Delaware.

CHAPTER VI.

Sulphureous Springs of New York—Are numerous—Sharon—Avon—Their medicinal effects—Various diseases in which useful—Quantity to be drunk.

THERE is scarcely a single county in the State in which springs of this class, impregnated with sulphuretted hydrogen, are not found; and in the fourth district, we are told by Mr. Hall, who made a geological survey of it, that in almost every rock these springs occur. Those which are abundant in water and highly charged with the gas are, however, few in number. They contain, besides sulphuretted hydrogen and carbonic acid, carbonate and sulphate of lime, which are deposited upon the twigs and stones over which the water flows.

Springs of this nature, Mr. Hall remarks, which issue from different rocks, have an aspect and general character which indicate their relative geological positions. In the strata of the Niagara group, the water has usually a dark appearance in the spring, though it is limpid and differs essentially from the waters of the salt group, while in higher rocks it is not only less copious, but it is often marked by a black and red deposit, as well as sometimes a whitish stain upon the rock, or at the bottom of the spring. The flow of water is feebler, and it is less strongly impregnated with gas. A temperature above that of the common springs was noticed in all the sulphureous ones in widely different positions, indicating a common cause. With the exception of the Sharon Springs, all the other sulphureous ones in Western New York, in the first district of geological survey, are situated in or near lines of fracture, or of great disturbance in the strata by some subterranean force.

Among the sulphureous springs of New York, those of Sharon and of Avon take precedence.

SHARON SPRINGS.

These springs are near the village of Leesville, in the town of Sharon, Schoharie

County. They rise at the junction of the water-lime and Onondaga salt groups, and, as described by Dr. Beck, from the pyritous slates lying under the Helderberg limestone series. The two chief ones are called the *White Sulphur*, and the *Magnesia*. The water of the first, on flowing over vegetable or other substances, leaves a deposit of sulphur on them. So tenacious is it of its distinctive characters, that it preserves them while flowing with common water for a quarter of a mile, after which it falls perpendicularly over a ledge of rocks sixty feet, with a volume sufficient to turn a grist-mill.

A large and well kept hotel has been erected on the hill above the Springs, from which an extensive and picturesque view of the surrounding country is obtained.

Visitors can enjoy themselves, during a portion of every day, in strolling along pleasant and shaded walks through extensive woods contiguous to the Springs.

Sharon is reached from the north and the east by way of Albany, where travellers take the cars on the Albany and Binghampton

Railroad to Palatine Bridge; and then stages over the mountain to the Springs. Travellers from Philadelphia and the South and the West can either go to New York and follow the route just designated, or take another, on the junction railroads from Philadelphia by way of Tamaqua, Danville, Williamsport, Elmira and Binghampton to the Palatine Bridge. The better plan, perhaps, will be to go to Sharon by way of Albany, and return on the junction railroad *via* Williamsport to Philadelphia, so as, in both going and coming, to pass over the mountain by daylight.

One pint of the water of the Sulphur Spring, analyzed by Dr. J. R. Chilton, of New York, yielded the following ingredients:—

	Grains.
Sulphate of magnesia	2.65
Sulphate of lime	6.98
Chloride of sodium	0.14
Chloride of magnesia	0.15
Hydrosulphuret of sodium Hydrosulphuret of calcium	0.14
	10.06

Sulphuretted hydrogen gas, 1 cubic inch.

"It is worthy of remark," adds Dr. Beck, "as perhaps throwing some light upon the origin of this water, that sulphate of lime, in small but perfect crystals, is found near the spring, in considerable abundance."

The solid contents of a gallon of this water, as determined by the same chemist, are 160.94 grains, and the amount of sulphuretted hydrogen gas 16 inches. These results, as reported by Dr. North,* are at variance with the preceding table of reduction to a pint, made by Dr. Beck, still from Dr. Chilton's analysis.

The Magnesia Spring contains, according to Professor Lawrence Reed, of New York, the following ingredients, in a gallon of the water:—

Bicarbonate of magnesia	30.5
Sulphate of magnesia	22.7
Sulphate of lime	76.0
Hydrosulphates of magnesia and lime	0.5
Chloride of sodium and magnesium	3.0
	132.7

Sulphuretted hydrogen, 3.3 cubic inches.

The medicinal virtues of the Sharon waters will be noticed after a description of those which follow.

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* Op. cit.

AVON SPRINGS.

Dr. S. Salisbury speaks of the town of Avon, near to which are the springs, as one of the most beautiful as well as productive in the State of New York. It is on the eastern branch of the Genesee River, in Livingston County, eighteen miles from Rochester, and twenty-four miles from Canandaigua. "The village of Avon is eligibly situated about one mile from the river, having an elevated position upon the table land, and commanding a prospect of the flats, for an extent of many miles. The mineral springs are between the village and the river, in the valley below."*

Stages leave Rochester daily for the Springs; and packet boats, which run on the Genesee Valley Canal, also land passengers within ten miles of the Springs; from which point they are carried in coaches to the desired spot.

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* A Descriptive, Historical, Chemical, and Therapeutical Analysis of the Avon Sulphur Springs, Livingston Co., New York.

These springs were long known to the Indians, who resorted to them for the cure of diseases of the skin, and even now a few of this unfortunate race are still seen to visit some of their old haunts. In the year 1792, one of the inhabitants of the district used the waters with perfect success in the cure of a disease of the skin, following intermittent fever; and in 1795, a cure of rheumatism of long standing, which had resisted the treatment of a number of intelligent physicians, was speedily and entirely cured by their use. The first approach to anything like accommodations for visitors was in the erection, at the lower spring, of a small building, with a *showering box* as it was then not inappropriately called. There are now three hotels in the immediate neighborhood of the springs and two in the village: a connection between them is kept up by omnibuses.

Three of the springs of Avon differ but little from each other in their chemical composition. Until the year 1835 there were but two springs known, and they were distinguished as the *Upper* and *Lower*. In that year a third, called the *New Bath Spring*, was discovered. It is spoken of by Dr. Beck as the first spring. Its depth is about thirty-six feet, and the formation through which the water rises is the calciferous slate, similar to that found at Rochester. The temperature is about 50° F., and its specific gravity 1.00356.

One pint of the water of the Avon New Spring contains

	Grains.
Carbonate of lime	3.37
Sulphate of lime	0.44
Sulphate of magnesia	1.01
Sulphate of soda	4.84
Chloride of sodium	0.71
	10.37

Sulphuretted hydrogen, 3.91 cubic inches.

The Middle Spring, as the Upper is now called, in reference to the relative situation of the three springs, is situated about thirty rods from the New. Its temperature is 51° F. Its composition, taking a pint as the measure of the quantity of the water, is, according to Professor Hadley, as follows:—

	Grains.
Carbonate of lime	1.00
Sulphate of lime	10.50
Sulphate of magnesia	1.25
Sulphate of soda	2.00
Chloride of sodium	2.30
	17.05

	Cubic Inches.
Sulphuretted hydrogen	12.00
Carbonic acid	5.60
Gaseous contents	17.60

The Third or Lower Spring, in its original state, formed, as we learn from Dr. Salisbury, a large pool of perhaps fifty feet in diameter, in which the earlier inhabitants were in the habit of bathing. It was the one first made use of, and, either from its less disagreeable taste or less nauseating qualities, it has always been more resorted to than the rest, and has been found to be generally more effective as a curative agent. The smaller proportion of hydrosulphuric acid, or sulphuretted hydrogen gas, contained in this water than in that of the other springs, makes it less liable to produce nausea and vertigo, and some degree of oppression to which they occasionally give rise.

The water issues from a fissure in a rock, thirty-six feet below the surface of the ground, about one hundred rods from the Genesee River, and about thirty rods from the Conesus Creek. The volume of water discharged from the spring is great, being estimated at fifty-four gallons in a minute; and it is the same at all seasons of the year. The temperature is 45° to 47° F. Specific gravity 1.0018. It is limpid, transparent, and somewhat sparkling. Its taste is decidedly sulphureous, and at the same time bitter and saline. An analysis by Dr. J. R. Chilton gave, in a pint—

	Grains.
Carbonate of lime	3.58
Chloride of calcium	1.05
Sulphate of lime	7.17
Sulphate of magnesia	6.21
Sulphate of soda	1.71
	19.72

	Cubic Inches.
The gaseous contents were, of sulphuretted hydrogen	1.32
Carbonic acid	0.50
Nitrogen	0.67

And a minute fraction of atmospheric air.

The water of the Lower Spring is, it will have been seen, somewhat richer in saline contents, and has less sulphuretted hydrogen than that of the Middle, formerly the Upper Spring.

Iodine or Sylvan Springs.—About two miles south of the Lower Spring, we meet with this group, three in number, of one of which we have an analysis. The three are distinguishable from the ones already described by their saltish taste, which is owing to the predominance of the chloride of sodium. One has but a slight sulphureous impregnation, and in taste resembles the Saratoga water, after exposure of this latter to the air and the escape of its carbonic acid. The other contains iodide of sodium together with a large proportion of chloride of sodium. An analysis of a gallon of the water gave, according to Dr. J. R. Chilton—

	Grains.
Chloride of magnesium	62.400
Chloride of sodium	97.440
Sulphate of lime	80.426
Sulphate of magnesia	12.960
Carbonate of lime	26.800
Carbonate of magnesia	15.974
Vegetable matter	.240
Iodide of sodium	
	296.240

	Cubic Inches.
Sulphuretted hydrogen	20.684
Carbonic acid	4.992
	25.676

Medicinal Effects of the Sharon and Avon Waters.—Although the Avon is stronger in sulphureous impregnation than the Sharon Springs, we may with propriety look on them both as possessing nearly the same therapeutical value, and, in fact, as resembling in this respect other waters of their class, both in New York and in Virginia. What has been said of the stimulating effects of mineral waters in general, is particularly applicable to the sulphureous. These latter excite the gastro-intestinal mucous membrane, and, according as they are more or less digested, they will produce either increase of appetite or the reverse state; either constipation or diarrhœa. When they do not immediately act as purgatives, they quicken the pulse, give rise to a feeling of internal heat, and to sleeplessness and restlessness, a state of excitement compared by Bordeu to that produced by coffee, and which may be carried to the extent of a slight intoxication. Their operation is terminated by a copious sweat, and sometimes an exanthematous eruption or copious discharges of urine, which serve as crises in most chronic diseases.

It is not easy to lay down the period in which these effects of sulphureous waters are fully obtained. The picture just drawn is by a French hand, and in its composition we must make allowance for the circumstance of the writer having in his mind the action of thermal sulphureous waters, both taken as a drink and used as a bath. At the same time it must be said, that the same general features are attributed to the operation of the cold sulphureous springs of France, those of Enghien for example; and we may, in comparing them with observations made at home, admit their general accuracy.

Coincident with this view is the opinion, based on large experience, that sulphureous waters exhibit their best curative effects, not only in chronic diseases, to which their use ought always to be restricted, but also in depressed and exhausted states of the system, in which it is necessary to rouse and reanimate, as it were, the vital energies, and to restore active sympathies between organs which had, to a certain extent, been severed. The persons who are most benefited by the use of these waters, are those of a lymphatic or phlegmatic temperament.

In the professional as well as in the popular creed, the use of sulphur in its various states—fixed and volatile, is associated with *cutaneous affections* of a chronic nature, and especially the varieties of psora and herpes. Sulphureous waters have been much lauded in what are vaguely called *chronic diseases of the chest*, and in which have been included, not only pulmonary catarrh and bronchitis, but also pneumonia, pleurisy, asthma and phthisis itself. We may simplify the subject by fixing our attention on the chief pathological element in these different diseases, to which our therapeutics, under the circumstances, should be directed. This is the chronic irritation and inflammation of the bronchial mucous membrane, in which, mainly if not solely, the medication by these waters will be found serviceable in pectoral diseases. By restoring or moderating when excessive, and otherwise modifying its secretions, we may hope to remove simple bronchitis itself, and to mitigate asthma and chronic pneumonia, congestion, and phthisis, in a certain stage of all of which diseases there is often symptomatic or secondary bronchitis. On the lungs proper, in the morbid changes to which they are subjected by chronic hepatization, or by tubercular deposit, sulphureous waters not only fail to exert any sanative or controlling influence, but they prove absolutely deleterious; and in confirmed phthisis, and even in the incipient stage, when accompanied with febrile irritation, they accelerate the march of the disease.

It has been contended that when these waters are serviceable in pectoral affections, their salutary effects are obtained by revulsive action—determination to the skin, and increase of its perspiratory function, as well as diverting the fluids from the centre to the periphery. Such results are most likely to follow the use of thermal sulphureous waters, and still more readily and completely if they be employed at the same time as a bath. But while admitting this view, which to a considerable extent is the correct one, it ought not to be received to the exclusion of a belief in the directly expectorant operation of sulphureous waters. As eminently diffusible and reaching all membraneous tissues, so as to be compared to mercury itself, we cannot, witnessing the strong action of this remedy on the secretions of the skin, deny it to those of the mucous membrane which lines the air passages.

We may, I think, explain by these two functional actions of expectoration and perspiration, under the use of moderate doses of the milder sulphur waters, the diminished frequency of the pulse and the abatement of febrile excitement, which have caused some of them to be regarded as sedatives, although, in fact, these are but secondary or indirect results, sequences at least of previous excitement. This order of succession of morbid phenomena is not unusual after the use of admitted stimulants in the class of purgatives and diuretics, as well as when other diaphoretics and expectorants besides the sulphureous are administered.

With the return to a qualified belief in humoral pathology, based as it now is on experimental knowledge, we can treat with respect the opinions of those European writers who explain many of the good effects from the use of sulphureous waters, both in pectoral and other diseases, to their bringing back to their original type, and at times eliminating from the organism certain morbific principles or humors, such as the rheumatic, the gouty, the herpetic, and the psoric. One proof of these remedies having accomplished this end, is supposed to be in a "Crisis" or "Bath Storm," a general stirring up and perturbation of all the functions, particularly the circulation and the secretions, and above all of those from the skin. A crisis will be manifested not only by copious sweating, but also by increased intestinal discharges, or by the supervention of exanthemata, and furuncles on the skin, or of abscesses under this tegument in the cellular tissue.

These waters have been had recourse to beneficially in a weakened state of the digestive apparatus, unaccompanied by fever or irritation, or when there is no morbid heat of the skin, or dryness and redness of the tongue. They are useful in dyspepsia, when the appetite is deficient, and the patient is troubled with heart-burn; also, in general debility, not maintained by inflammation or irritative fever; in indolent engorgements of the liver and other abdominal viscera, resulting from periodical fever; in chronic catarrh of the bladder, and gravel; in chlorosis, leucorrhœa, inveterate gonorrhœa, and nocturnal pollutions; and in tremors, and paralyses caused by lead poisoning.

Rheumatism will be benefited by the use of sulphureous waters in proportion to its chronicity and the absence of any degree of excitement, and probably, also, to its being associated with disordered digestion. It is under these circumstances that the use of the warm sulphur bath, or even a bath of common thermal water, will accelerate greatly the cure. Other disorders from suppressed perspiration, such as stiffness of the limbs and partial dropsy, will be relieved by the same treatment.

In scrofula, rickets, and swellings of the lymphatic glands, the administration of sulphureous waters has been with many a favorite, as it certainly is a salutary, mode of practice. There is not only an amendment of the general health by these means in scrofulous children, as evinced by their improved digestion, a soft and supple, in place of a tumid and resisting abdomen, and renewed strength; but, also, of the ulcers and fistulous cavities which assume the appearance and character of common and well-conditioned sores. Even here the milder sulphur waters, or the stronger in small quantities, are to be preferred. Iodine in the form of ointment may be rubbed, with advantage, on the enlarged lymphatic glands, and applied to the scrofulous ulcers, during the continuance of the sulphureous treatment. Iron is also a good adjuvant in many diseases in their less active forms, or in an atonic state of the system, in which the sulphureous waters have been recommended.

By French writers, the triumph, as they call it, of sulphureous springs, is evinced in the treatment of wounds, and especially of those caused by fire-arms. Above all, the waters of the thermal springs of the Pyrenees have, for the last century and a half, been eagerly resorted to by this class of patients, and certainly the changes in the condition of large numbers of them by this agency have been most surprising and even marvellous. They who went lame, and halt, and crippled, and distorted in limb and often in body, have come away erect, and able, not only to walk, but to dance and to indulge in gymnastic sports. Much, however, very much of those results are due more to the thermal than the sulphureous character of these famed springs, and to the combined use of their waters by drinking and by bathing. Our Virginia friends, and the good people of North Carolina and Arkansas, and the inhabitants of Deseret and the regions thereabout, ought to study and ponder well on the diversified and admirable results in the cure of disease obtained by the simple thermal waters of Europe, and bestir themselves accordingly to fit up suitable balneatory establishments, with all due appliances for douching and illutation, or, in plainer language, spout and mud baths.

Doctor Salisbury, in his sensible little volume on the Avon Waters, lays down with considerable accuracy the indications for their medicinal uses: as, for example, when there is a call for increasing the action of the organs or of the tissues, in chronic diseases of the liver, and in chronic rheumatism, diseases of the skin, and of the urinary passages. "In obstinate dyspepsia attending a debilitated or depressed state of the digestive functions, acidity, flatulence, and heart-burn, in that which succeeds to acute diseases, and is accompanied by jaundice, frequent vomiting of mucus, pain in the right side, or in the region of the stomach, this remedy may be so administered as often to afford prompt and effectual relief." The writer quotes Dr. Frances to the same purport. I regret not having access to this estimable and experienced gentleman's papers on the Avon Springs. Scrofula and asthma are mentioned by Dr. Salisbury as diseases in which the curative powers of these waters have been exerted in a marked manner. They have, also, he tells us, been much and beneficially employed in chlorosis, leucorrhœa, amenorrhœa, and difficult and painful menstruation. In the sulphureous treatment of these disorders, we must continually bear in mind the conditions on which alone it can be had recourse to, not only with benefit but without doing harm. It is not enough for us to know that females are suffering in the various ways just enumerated, but we must also take note of their temperament, freedom from an inflammatory condition of any part, as well of the uterine as of the digestive system, and from chronic pulmonary disorder, such, more particularly, as phthisis, before we venture to prescribe a course of these waters. In the early period of pregnancy, they ought either to be withheld entirely, or administered with great caution.

As regards the quantity of the Avon water to be drunk in a given time, Dr. Salisbury tells us that, generally speaking, four to six half-pint tumblerfuls, during the day, produce a mild cathartic effect. "In larger doses, they operate powerfully upon the bowels and kidneys." Their alterative effects are of course to be obtained by the moderate use of them, and in much smaller quantities than those given with a view to their cathartic operation.

An aperient effect is more readily obtained by warming the sulphur water, although by this process it loses a portion of its sulphuretted hydrogen, and if continued, the whole of this gas would be evolved. Certainly by this means it sits more easily on the stomach of a delicate invalid, and exerts a kindlier effect afterwards. In some cases of gastralgia and weakened state of the stomach, with general debility and languid circulation, the cold water from the spring could not be borne. It is worthy of remark, in this place, that the most celebrated of the thermal sulphureous springs of the Pyrenees do not contain any sulphuretted hydrogen, and the only gaseous constituent in some of them is azote. This is the case with the springs of Bareges, Saint Sauveur, Cauterets, Eaux Chaudes, and Bagneres de Luchon. Those of Bounes have a small proportion of sulphuretted hydrogen, and of carbonic acid in nearly equal quantity. In all of them the sulphur is combined with sodium, in the state of a sulphuret, and on this salt depend their sulphureous properties. Does it exist in our sulphur waters? As yet it has not been exhibited in any of them by analysis. When speaking of the Virginia Springs, I shall allude to a division of sulphureous waters, based in part on some of them being impregnated with sulphuretted hydrogen, and others with the sulphuret of sodium.

Reverting to the dose of the Avon and other waters of the same nature, viewed as alteratives, if the general indications point to their use but they are found in the common quantity to be irritating or oppressive, we ought to reduce the dose to a minimum, and some might think inert proportion. Even the comparatively mild waters of Saint Sauveur, which contain not a fifth of a grain of sulphuret of sodium in the pint, and not a fourth of the saline contents of those of Avon, are prescribed by the experienced M. Fabas, at first in a dose of only three or four ounces, gradually increased. It will be remembered, however, that they are thermal, or from 86° to 95° F. With our notions of heroic or energetic practice, we may feel disposed to smile at this which some will call a timid and inefficient course; but in the treatment of chronic disease, we must often descend from the heroics, and admit more largely into our calculations, as important elements, time and nature. While doing so, we shall be able to draw largely from the experience afforded by clinical practice at mineral springs, which as yet is barely begun in the United States.

It has been observed by some of the physicians at the Pyrenean Springs, and the remark is worthy of being remembered, that the exciting effects of sulphureous waters are most evident on persons in health, and especially on those of a sanguine and excitable temperament; and that their use is much better borne in a state of disease. The toleration in this respect is diminished as convalescence approaches; and hence the propriety of gradually diminishing the quantity of the water to be drunk in the last period of the treatment, and for the reason already assigned, of increasing it in the first period.

The *external* use of the Avon waters by *bathing* ought to accompany their use as a drink in most of the diseases to which they are deemed appropriate. More especially does this advice hold in cases of chronic cutaneous diseases, and of chronic rheumatism, and in those in which a revulsive action is desired for the relief of internal organs. With few exceptions, the temperature of the water for the bath ought to be raised by artificial means, so as to render it tepid or warm, and, on rarer occasions, hot, according as there are cutaneous excitement and general irritation, or the reverse state of atony of the skin and general debility. The latter will authorize a bath of a temperature approaching to the hot, the former one of a lower temperature, bringing it down to the tepid.

In the absence of more precise details and specifications, such as we find in the little volume by Dr. Salisbury on the Avon waters, the reader may apply what has been said of these latter, and of the action of the sulphureous class in general, to the use of the *Sharon Waters*, the popularity of which, on what we must believe to be good grounds, is growing from year to year. Strong testimony is borne in favor of the efficacy of bathing in the water of the White Sulphur Spring at Sharon.

Excursions in the course of the Genesee River may be made by visitors to Avon, which will afford them views of scenery of great variety and grandeur; as, for instance, the Falls at Portage and the Upper Falls at Nevada. "There is a beautiful and clear lake, called the Conesus, about six miles from the springs. Three miles from its outlet is a cape of forest land, extending far out on the lake, which has been for some years past a favorite resort for parties of pleasure. The lovers of romantic scenery will pass a day here with delight."

CHAPTER VII.

Other Sulphur Springs of New York—Clifton—Chittenango—Manlius Springs and Lake—Messina—Auburn — Rochester — Verona — Saquoit — Newburgh — Albany, &c. &c.

Clifton Springs.—These will probably rank after the Avon and Sharon, as among the most active in the State. They are, we believe, the same as those described by Mr. Hall in the eastern part of the town of Manchester, Ontario County, and on the road from Vienna to Canandaigua. The odor of the gas which they give out is perceptible at the distance of a quarter of a mile. From one of the springs the quantity of water discharged is unusually large. Deposits of carbonate of lime and sulphur are found in the vicinity. All these springs, as we learn from Dr. Beck, as well as those which occur at Avon, have their origin in the hydraulic limestone, near its junction with the limestone above. Temperature 51° F.

Chittenango Springs.—They are situated in the valley of the Chittenango Creek, in the vicinity of the village of the same name, in Madison County, and issue from the hill of calciferous slate which here forms the eastern boundary of the valley. The two chief springs on the lands of Mr. Yates and Judge Warner—the first about a mile, the second two miles from the village—have a temperature of 49° F., and contain, together with carbonates and sulphates of lime, sulphate of magnesia and chloride of sodium, sulphuretted hydrogen gas and carbonic acid. The spring of Mr. Yates has also sulphate of soda in solution. The water of that of Judge Warner, when fresh from the spring, has an opaline or milky appearance, which disappears on boiling. A whitish precipitate is found at this time. Incrustations of sulphur, and of carbonate and sulphate of lime are seen on leaves, twigs, and pieces of wood in the vicinity of both of these springs.

"The waters just described," adds Dr. Beck, "are highly esteemed in many cases of disease, and their location is so eligible that

I do not doubt that, when they are better known, they will be much resorted to."

Manlius Springs and Lake.—These and other sulphureous springs of Onondaga County are more numerous and better known than those of Madison County. About a mile from Manlius Square are three springs very near to each other, all of which are feebly charged with sulphuretted hydrogen. They have also a slightly saline taste, and have acquired some reputation in the vicinity.

Two miles east of Manlius Centre is a sulphureous lake or pool, known by the name of Lake Sodom or Green Pond. It is about a mile and a half in length, and half a mile in breadth at the widest part. The depth gradually increases, as we proceed from the northern outlet, from twenty-five to a hundred and sixty-eight feet, at what is probably the centre of the basin. Water drawn from this depth was found to be highly charged with sulphuretted hydrogen. It is of a deep green color, which Dr. Beck, to whom I am indebted for the entire description of this water, suggests is probably owing to the partial decomposition of the sulphuretted hydrogen. Its specific gravity is scarcely above that of common water.

Sulphuretted hydrogen gas is evolved in great quantities in the immediate vicinity of the Salt Springs at Salina and Syracuse. A spring on the grounds of Mr. E. F. Wallace, of Syracuse furnishes a sulphureo-saline water, in one pint of which there are 132 grains of chloride of sodium. Its gaseous contents are sulphuretted hydrogen and carbonic acid. Another spring of a similar character, a mile distant, is found in the marsh near the Salina Well.

Messina Sulphur Springs.—They are situated in a ravine near to that in which are found the springs of Manlius and Chittenango, three miles northeast of Syracuse, and a mile north of the Erie Canal. They rise through a limestone formation, on the surface of which are everywhere found masses of calcareous tufa. The temperature is uniformly 50° F. The water has a strong sulphureous taste, but is not so highly charged with sulphuretted hydrogen as that of some other springs. It is used with good effect in many diseases. Its composition in a pint is as follows:—

	Grains.
Carbonate of lime	1.85
Sulphate of lime	8.55
Sulphate of magnesia	1.36
Chloride of calcium	1.33
	13.09

It has been remarked by Dr. Beck that the number of springs of this class increases as we go westwardly in the State.

Auburn Springs.—One of these is in the town of Sennett, two miles north of the village of Auburn, in Cayuga County. Another, which has acquired some reputation, is situated about four miles west of Auburn, on the farm of Mr. Nelson Van Ness. It is called the West Auburn Spring. An analysis by Dr. Chilton exhibits the following substances in a pint of the water:—

	Grains.
Sulphate of lime	15.00
Sulphate of magnesia	3.20
Chloride of magnesium	0.25
Chloride of sodium	0.75
	19.20

Sulphuretted hydrogen gas 1.5 cubic inches.

At *Spring Mills*, on the eastern shore of Cayuga Lake, a sulphureous water is said to issue from the earth in quantities sufficient to turn a grist-mill. It is perfectly limpid, and has a strong taste and smell of sulphuretted hydrogen.

Rochester Spring.—In the city of Rochester, on the east bank of the Genesee, is Longmuir's sulphur spring, the waters of which are much employed by the inhabitants. It rises through a boring of two hundred feet in depth. Its temperature is usually 52° F., affording an instance of the increase of temperature of the earth as we descend beneath the surface. When heated to 100° F., it deposits sulphur and carbonate of lime. Its specific gravity is 1.00407. One pint of the water contains—

	Grains.
Carbonate of lime and magnesia with a trace of iron	1.48
Chloride of sodium	6.52
Sulphate of soda	6.99
	14.99

Gaseous contents: sulphuretted hydrogen, 2.16 cubic inches, with a small quantity of carbonic acid.

In proof of the copious evolution of sulphuretted hydrogen in this district, Dr. Beck mentions the fact, in reference to the Caledonia Springs in the town of Wheatland, that the whole of a large volume of water which gushes out of the earth, so as to form a stream nearly one-quarter of the size of the Genesee River at Rochester, is slightly impregnated with this gas.

In this county (Monroe) we meet also with the sulphureous springs of Mendon, Gates, and Pittsford, at all of which, as well as those of Rochester, there are bathing-houses and ample accommodations for visitors. More abundant in sulphuretted hydrogen than any other in the county, is a spring at the village of *Ogden*, in the township of the same name, one and a half miles south of Spencer's Basin.

Verona Spring.—This spring is 14 miles from Utica, in Oneida County. Its water, as analyzed by Professor Noyes, gave the following constituents in a pint:—

	Grains.
Chloride of calcium, with chloride of magnesium	8.50
Sulphate of lime	7.50
Chloride of sodium	90.00
	106.00

The water is supposed to be nearly saturated with sulphuretted hydrogen gas.

Saquoit Springs.—The water of these springs, nine and a half miles south of Utica, is highly charged with sulphuretted and carburetted hydrogen, and contains the chlorides of sodium and magnesium in considerable quantities, together with a little sulphate of lime and a trace of iron. The gas rises from the water in such abundance as to allow of its being conducted through tubes, and to be kept continually burning.

Sulphur Springs of Niagara County.—This county is no less abundantly supplied with sulphur springs than those which have been already noticed. Among them may be mentioned those in the town of Pendleton, near the canal, at Lockport, two miles from Tonawanda; in the vicinity of Lewistown, and of the Falls of Niagara.

Seneca or *Deer Lick Springs* are about four miles from Buffalo (Erie County), and issue from opposite sides of the stream on which they are situated. They give out sulphuretted hydrogen largely, and contain of saline substances, carbonates of lime, magnesia, and soda, together with sulphate of lime in notable quantities.

There is an acid spring on Grand Island.

Sulphur springs are also found in Northern New York, in the counties of Clinton, St. Lawrence, and Lewis.

In the *Valley of the Hudson*, beginning at the southern part of the State, sulphureous springs are found at short intervals from near Sing Sing, in Westchester County, to Fort Miller, in Washington County, a distance of nearly a hundred and fifty miles. They occur on both sides of the Hudson, and usually rise through the strata of glazed black slate which is found throughout nearly the whole of this extent. Of these springs, we may mention, after Dr. Beck, the *Chappequa Spring*, four miles northeast of Sing-Sing, which issues from a cleft in the rock near the base of a hill, about two hundred feet in height. The salts held in solution are said to be the sulphate of lime, chloride of calcium, and the muriate of iron and manganese.

Harrowgate Springs, near the village of

Greenbush, and a spring near the north end of the city of *Troy*, are in Rensselaer County.

The sulphureous springs of Saratoga County have been already mentioned.

Newburgh Spring is in Orange County. In Albany County, also, there are several springs of this class; one of them in Wendell's Hollow, near the city of Albany.

In *Dutchess County* is a sulphur spring near Ameniaville; and there are several in *Columbia*, one of which is on McNaughton's farm, between Lebanon Springs and the Shaker Village; and another near Kinderhook.

Catskill Spring.—This sulphureous water rises within two miles of the village of Catskill, Greene County. There are several others in the same county.

In the *southwestern counties* we have to record the existence of numerous sulphureous springs.

The *Nanticoke Spring*, in Broome County, was formerly in considerable repute.

Dryden Springs, in the town of the same name, and ten miles east of Ithaca, in Tompkin's County, have acquired some celebrity.

The counties of Chenango, Tioga, Stephen, and Cattaraugus have their sulphur springs.

In *Chautauque County*, sulphur springs are of frequent occurrence, and, as stated by Dr. Beck, they have apparently some connection with the issues of carburetted hydrogen gas, for which this county has become so celebrated. Sulphureous springs are found at Fredonia, and on the shore of Lake Erie about a mile east of Van Buren Harbor.

CHAPTER VIII.

Acid Springs, called also Alum Springs—Byron Acid or Sour Springs—Oak Orchard Acid Springs—Their composition—Diseases in which used—Acid Springs in South America—Nitrogen and Thermal Spring of Lebanon—Brines, or Salt Springs—Gas Springs.

ACID SPRINGS.

THESE springs are thus designated on account of the excess of sulphuric acid in their waters, which is perceptible both to the taste and by reagents. They also contain, in considerable proportions, sulphates of alumina and of iron, and hence we shall find them designated as *alum springs;* and they might, also, with propriety, be ranked under the head of *chalybeate.* They are found chiefly in New York and in Virginia. I shall notice, now, those of the first mentioned State; and, as in the case of the sulphureous springs, draw largely from Dr. Beck's oft quoted volume, "*Mineralogy of New York.*"

Byron Acid or *Sour Springs.*—There are two acid springs in the town of Byron, Genesee County. The first is in the southwest corner of the town, and rises from a hillock about two hundred and thirty feet long and one hundred feet broad, elevated four or five feet above the surrounding plain. According to Professor Eaton, the strength of the acid increases in a drought. Wherever holes were sunk in the hill, the acid accumulated, and also in the depressions of the contiguous meadow-grounds.

There is another acid spring, a hundred rods west of Byron Hotel and two miles east of the former, which is remarkable in consequence of the great quantity of acid contained in its water. This spring issues from the earth in sufficient quantity to turn a grist-mill. There is said to be several other acid or sour springs in this vicinity.

The acid liquid is described by Dr. Beck to be transparent and colorless, and to have a specific gravity of 1.11304 at 60° F. It reddens litmus powerfully, and has an intensely sour taste. The lime and oxide of iron indicated by tests, are in very small proportion, as is evident from the fact that, when the liquid is evaporated, only a trifling residuum is left. "It is a nearly pure, though dilute sulphuric acid, and not a solution of acid salts, as has been supposed; for the bases are in too minute a proportion to warrant the latter opinion.

"The brownish matter, or acid earth, is principally vegetable matter, charred by the action of the acid; but it also contains some silica and alumina, with a minute quantity of lime and oxide of iron. When this matter is boiled in water, a solution is obtained which possesses all the properties of the liquor just described."

Acid springs or wells are also found in the town of Bergen, in this county.

Oak Orchard Acid Springs.—Within a few years past, attention has been directed to these springs, eight in number, which are eight miles southeast from Lockport, in Genesee County, and six and a half miles from the village of Medina, on the Erie Canal. Analyses by Dr. Chilton and Professor Emmons, show them to be not only acid, but, also, saline waters of great therapeutic value.

The following ingredients were found in a gallon of the water, by Dr. Chilton's analysis:—

	Grains.
Free sulphuric acid	82.96
Sulphate of lime	39.60
Protosulphate of iron	14.32
Sulphate of alumina	9.68
Sulphate of magnesia	8.28
Silica	1.04
Organic extractive matter	3.28
Equal to about 20 grains in a pint	159.16

The analysis of Spring No. 1, by Professor Emmons, gave a much larger proportion of the above constituents. In one pint of the water he found of—

	Grains.
Free sulphuric acid	31.50
Sulphate of protoxide of iron	19.50
Sulphate of lime	4.50
Sulphate of magnesia	2.00
Silica	0.33
Organic matter	1.33
Equal to 473.28 grs. in a gallon	59.16

Spring No. 2 had but 24.25 grains of free acid and of saline contents in the pint, and No. 3 only 19.33 grains. Differences in the strength of the several springs will depend on the volume of water which passes through the bed or rock in which the acid and salts are found; and differences observable in the strength of the same water at different times are explained by the different amounts of meteoric water which percolates through the bed or rock at different times, according as there has been light or heavy rains.

Medicinally considered, these acid waters, as might be inferred from their composition, have a powerful astringent and tonic effect in debilitated states of the general system, and in enfeebled function of different organs, especially of the digestive and uterine accompanied with perverted secretions and exhausting discharges, as in pyrosis, gastrodynia, chronic diarrhœa, and chronic dysentery and leucorrhœa: also, in chronic affections of the kidneys and bladder. To this list, Dr. S. P. White, in a paper read before the New York Academy of Medicine (December 6, 1848), on these springs, adds diabetes, passive hemorrhage, such as *purpura hæmorrhagica*, some of the cutaneous diseases, and the colliquative sweats of hectic fever. He thinks it is entitled to consideration, also, in the phosphatic diathesis, accompanied by deposits of the phosphates, and in colica pictonum and asthma, as well as in chronic pharyngitis and laryngitis, and chronic conjunctivitis. Dr. Spring found it to give entire relief in a case of diarrhœa of three years' duration.

The dose recommended by Dr. White, is about a third of a wineglassful, diluted with simple water, three times a day. Locally, it is applied with advantage to chronic ulcers of the skin and throat, and in indolent cutaneous eruptions, as also in chronic conjunctivitis, and discharges from the ear.

There is an acid spring at Clifton Springs, twelve miles northwest of Geneva.

The traveller in New Grenada sees not only a spring, but a stream of some magnitude, largely impregnated with sulphuric acid. It is called, on account of its sourness, *Rio Vinaigro*, and also Passambio. Its mineral impregnation is slight, for of all the substances held in solution by the water, equal only to 2.87 parts in 1,000, the sulphuric acid amounted to 1.11, and the hydrochloric or muriatic 0.91=2.02, leaving only 0.85 of solid contents. In the smallness of these latter, this water seems to resemble that of

Byron. Not so, however, in reference to its acid, the quantity of which, delivered in twenty-four hours, is 38.611 kilogrammes, or 84,750 pounds avoirdupois in 34,784,640 cubic metres of water.

Even more remarkable than the one just described is the mineral acid spring of *Paramo de Ruiz*, in New Grenada, which issues with an abundant supply of water at an elevation of 3,800 metres, or about 12,450 feet above the ocean, where the Guali, a tributary of the Rio Grande de la Magdalena, takes its origin. Boussingault thinks it probable that this spring comes from trachyte. Its water is thermal, having a temperature of 157° F. Ruiz is an active volcano. The water analyzed by M. Levy gave, in 1,000 parts—

	Grains.	
Sulphuric acid	5.181	6.062
Hydrochloric acid	0.881	
Alumen	0.500	
Lime	0.140	
Soda	0.360	
Silica	0.183	
Magnesia	0.320	
Oxide of iron	0.365	
	7.930	

We see the same basic substances here as those in the Oak Orchard Springs, with the difference of soda, which is wanting in the latter.

The spring of Rio Vinaigro originates from the volcano of Puracé. The coldness of its water is owing, Boussingault thinks, to the melted snow mixing in its downward course with the acid springs of volcanic origin. Acid springs are not confined to the volcanoes of Ruiz and Puracé. Five cascades of strongly acidulated water were seen by the traveller just named, near the Indian village of Genoi, when he was ascending the crater of Pasto.

Acid springs issue at nearly the same elevation as that in which the best kinds of cinchona grow, and in the same neighborhood. Here, then, at a comparatively moderate expense, the manufacture of sulphate of quinine might be carried on.

LEBANON SPRING.

This is ranked, on the score of temperature, among the thermal springs, and of gaseous impregnation, among the nitrogen ones. The water is constantly at 73° F., while that of the other springs in the county (Columbia) is 52° F. Its saline impregnation is very slight, being only a grain and a quarter in the pint. The temperature is such as to render the Lebanon water a delightful bath. So copious is the supply that not only is there an abundance for all the baths; but there is also enough to turn two or three mills, erected within a short distance. These are kept running during. even the severity of the winter.

The water of Lebanon taken as a drink, will be found serviceable in irritable dyspepsia and in gouty habits, and in the thirst accompanying slow and hectic fever. As a bath it may be used under similar circumstances, and also in chronic rheumatism. The delicate and the feeble whose powers of reaction are slight, would, by bathing in the Lebanon waters for a time, be prepared for the greater depression and shock from sea-bathing.

I must not close this notice of the mineral springs of New York, without adverting to the numerous, and, in a measure, celebrated brine or salt springs of that State. The chief ones are those of Onondaga County, and of Montezuma, in Cayuga County.

Great uniformity prevails in the chemical composition of the waters of these different springs. All those, continues Dr. Beck, "which have been subjected to an analysis contain, although in somewhat various proportions, the chlorides of calcium and magnesium, in combination with the common salt. All of them, moreover, when freshly drawn, give the characteristic tests of iron, which exists in minute proportions in the form of carbonate; or, perhaps, in some cases, the oxide of iron may perform the part of an acid, which, by combining with lime, may thus exist in the form of *ferrate of lime.* Bromine is also known to be one of the constituents of the Salina brine, and it will probably be found in most of the others; but iodine has not yet been detected in any of them."

An important part of the revenue of the State is derived from the springs of Onondaga County, viz: the *Salina and the Syracuse Wells, and the Liverpool Well.*

Nitrogen springs are found at Hosick, Rensselaer County; at Canoga, in Seneca, and at Chateauguay, in Franklin.

Among the curiosities of springs in New York, we may mention those in which *carburetted hydrogen gas* is given out. In some places, as at the village of Fredonia, in Chautauque County, it is turned to economic account by being used for lighting the streets and houses. A sufficient supply of gas was collected at this place, in a gasometer, to feed seventy to eighty lights. Similar emanations occur in Albany, Oneida, Yates, Monroe, and Niagara counties.

CHAPTER IX.

Springs of Maine: Saline ones of Lubec—Chalybeate ones of Dexter. Springs of Vermont: Highgate—Newberry — Alburgh — Bennington — Clarendon.—Springs of Massachusetts: Berkshire—Hopkinton.—Springs of New Jersey: Schooley's Mountain—Its situation—Composition and virtues of the waters.

In the State of Maine, the chief mineral springs are:—

The *Saline Spring of Lubec.* It bursts out from the soil near the junction of the red sandstone and blue limestone rocks, on the bank of a creek near the head of Lubec Bay. The water is clear and colorless. Specific gravity 1.025. An imperial gallon evaporated to dryness gave, as a residuum, 322.5 grains of saline matter. 100 grains of this dry salt gave, on analysis, in a pint of water:—

	Grains.	Grains.
Chloride of sodium	64.0	199.000
Sulphate of lime	3.6	11.210
Chloride of magnesium	20.2	62.845
Sulphate of soda	9.0	27.985
Carbonate of iron	0.8	2.490
Carbonate of lime	2.0	6.250
Chloride of calcium	a trace	12.720 loss.
Carbonic acid gas		
	99.6	322.500
	4 loss.	
	100.0	

Dr. Charles T. Jackson, who gave these particulars respecting the Lubec Saline Spring, in his *First Report on the Geology of Maine*, does not add anything on the subject of its curative powers.

Dexter Chalybeate Spring.—This spring is situated on the eastern head branch of the Sebasticook stream. It deposits largely "an ochreous yellow oxide of iron." Dr. Jackson describes the water as a good tonic in various disorders of the digestive system.

SULPHUREOUS SPRINGS OF VERMONT.

Among these we may enumerate the *Highgate Springs*, within twelve miles of the steamboat landing at St. Alban's Bay; also the *Newburg Sulphureous Spring*, which is twenty-seven miles east of Montpelier, and forty-seven northeast of Windsor. It is by the side of Harriman's Brook, about fifty rods north of the meeting-house, and it is a place of considerable resort for invalids. The water is strongly impregnated with sulphuretted hydrogen gas. It is extolled in scrofulous and cutaneous diseases. A good shower-house and baths are constructed near the spring, and every accommodation is provided at the hotel, which can be desired by the visitor. Springs of the same kind are found in several other places in the township.

The springs of *Alburgh* are of the same nature as those just described.

Bennington Thermal Spring.—It is thus designated by Professor Hitchcock, who does not, however, give its temperature. It emits both nitrogen and oxygen gases. The water is abundant enough to turn the machinery of a powder mill.

Clarendon Gaseous Springs.—This water will rank with others of the milder acidulous class. In the small proportion of saline ingredients, but one in ten thousand parts of the water, it is among the purest known. Its gaseous contents are more copious, and impart to it whatever peculiarity it possesses. In a notice of this spring, written by Dr. Gallup, we learn, from an analysis by Dr. Hayes, that a United States gallon of 235 cubic inches contained—

	Cubic Inches.
Nitrogen or azote	9.63
Carbonic acid	46.16
Besides atmospheric air.	

Of the saline matter, 5.76 grains, carbonate of lime figures for 3.02, and muriate of lime, sulphate of lime, and sulphate of magnesia, 2.74 grains.

The gas evolved from the water at the reservoir was, in 100 cubic inches, as follows:—

Carbonic acid gas	0.59
Oxygen gas	1.05
Nitrogen gas	98.45
	100.00

Temperature of the higher spring 48° F., of the two lower springs 54° F.

The Clarendon waters enjoy a reputation in cutaneous diseases, chronic bronchitis, anasarca, and especially in irritable bladder. The quantity drank in the twenty-four hours varies from five to twenty half pint tumblers-ful. They at first excite a warmth and aching on the surface, sometimes attended with slight nausea. These sensations disappear when their diuretic action begins. This occurs in about six hours after drinking them.

Of the mineral springs of MASSACHUSETTS, I have no details excepting on the Hopkinson Springs, and the so called

Berkshire Soda Spring.—This, as far as a qualitative analysis goes, may be classed among the acidulous waters. For a mention of the substances thus detected, and some other particulars respecting this spring, the reader is referred to the following extract of a letter from Dr. Clarkson T. Collins to Dr. Valentine Mott, dated May 17th, 1852:—

"I must not close this letter without mentioning a very remarkable mineral spring situated among the mountains, a short distance from this village; and which has, for many years past, had a high *local* reputation for the cure of scrofula and eruptive diseases of the skin. The people in this part of the country consider it a specific for the cure of all that class of eruptive diseases which are popularly called by the vague and indefinite term of *salt rheum*.

"During the past year, by way of experiment, I have placed several obstinate cases of Eczema, Ecthyma, Acne, Porrigo, etc., under the exclusive treatment of this water, and the results have been very satisfactory; indeed, I may say that, in some cases, its effect was most extraordinary. So pleased was I with the use of this mineral water, that I sent a jug of it to New York City, and had it analyzed by Professor Doremus and Dr. Blake, the former assistant of Professor Silliman. It was found to contain soda, chlorine, carbonic acid, and a trace of alumina. Yet there is but little taste in it other than that of pure water. When bathed in, it imparts to the skin the most delightful softness of any that I have ever used, causing even a rough skin to feel smooth."

"The spring is located among the mountains, within three miles of the beautiful village of Great Barrington, Berkshire County, Mass., through which four daily trains of cars pass. Great Barrington is twenty-eight miles east of the Hudson River, and city of Hudson; ten miles from Hillsdale, on the Harlaem Railroad; twenty miles from Pittsfield; twenty miles from Lebanon; eighty miles from Bridgeport, and forty-eight miles from Albany, N. Y., on the line of the Housatonic Railroad, between the two last named places; rendering it very accessible. During the warm season, a carriage will be run regularly four times a day between the village and the spring. Warm, cold, and shower baths are obtained by the visitors."

It will be seen by the following extract of a letter from Dr. Collins to the writer, that the atmosphere of the vicinity of the springs is not only healing to the lungs, but exhilarating to the brain:—

"Wm. C. Bryant once practised law in this village. Dr. Holmes (professor), of Boston, resides in this county during the summer. G. P. R. James, the English novelist, owns a farm, and is building a house in this town, four miles from the village. Miss Catharine Sedgwick resides eight miles from here, and Melville twenty."

Hopkinton Springs.— These waters have

obtained some reputation in their section of country (as I learned, many years ago, from Dr. Bucklin) for the cure of scrofula and various affections of the skin. An analysis of the water of the chief spring, by Dr. Gorham, showed its constituents to be carbonates of lime, magnesia, and iron. Another one is highly impregnated with sulphur. Bathing in the waters is also recommended and practised.

The chief watering place in NEW JERSEY, is—

THE SCHOOLEY'S MOUNTAIN SPRING.

This spring, or rather rill, issues from a perpendicular rock, having an eastern exposure, between forty and fifty feet above the level of a brook which flows down into the channel beneath. A small wooden trough is or was adapted to the fissure, so as to convey the water to a platform where the visitors assemble and to the baths. The temperature of the water is 50° F., being 6° higher than the spring water nearer the summit. The quantity given out in an hour is thirty gallons, and it does not vary with season or weather. The water deposits oxide of iron on the troughs, baths, and even the drinking vessels. Its taste is strongly chalybeate. Iron ore abounds in the vicinity, and is worked to advantage in furnaces on both the eastern and western sides of the chain. Gray limestone is found at the base of the hills and along the valleys.

The predominant ingredients are muriate and sulphate of lime and carbonated oxide of iron, as we learn from an analysis by Dr. McNeven. On exposure to the air the iron is precipitated, and the water has then such slight sensible properties that it may be used for making tea. It will not bear transportation, even in corked bottles, without this precipitation taking place.

As a pure carbonated chalybeate, the water of Schooley's Mountain Spring is well adapted to a variety of chronic maladies marked chiefly by anemia, debility, and mucous discharges, in which there is no inflammation of an organ present. Its tendency to induce constipation must be watched, and this effect corrected by the use of mild aperients.

Schooley's Mountain, near the summit of

which is the spring, is supposed to be about 1,100 feet above the level of the sea. It forms part of the central granitic chain which extends in a northeast and southwest direction across the State of New Jersey, from the Delaware to the Hudson River. From the top of the mountain a turnpike road runs northward to Sussex, another westward to Easton, a third eastward to New York, and a fourth southward towards Trenton.

It is situated in Washington Township, Morris County, nineteen miles northwest of Morristown, fifty from New York, seventy northeast from Philadelphia, and fifty-six from Trenton. From New York, the visitor to the springs will go to Morristown by railroad and thence by stage, or to the White House by railroad and thence by stage. The springs are reached from Philadelphia by way of New Brunswick, and thence by stage six miles to Bound Brook, on the New Jersey Central Railroad. By this last he reaches the White House, and, again by stage, the springs.

In addition to the houses for the accommodation of visitors there are others differently occupied, and a church and schoolhouse, together with a post-office.

Among the amusements are fishing and boating on Budd's Pond, a beautiful sheet of water two miles in length by one in breadth, seven miles distant from the spring. The student and lover of geology may also find abundant materials to engage his attention and help him to wile away many an hour.—(*Gordon's Gazetteer of New Jersey.*)

CHAPTER X.*

PENNSYLVANIA SPRINGS.—In noticing the mineral springs of this State, I begin with

The Bedford Springs.—These rank foremost in Pennsylvania on account of their mineral properties and medicinal effects, and their mountain elevation and scenery. They are two miles from the town from which they derive their name, and less than two hundred miles from Philadelphia, and not one hundred from Pittsburg, on the great turnpike between these two cities; they are one hundred miles from Harrisburg, one hundred and thirty from Baltimore, and the same distance from Washington. The water of the chief spring (Anderson's) is a saline chalybeate. Others have received the designations of *Fletcher's*, or the *Upper Spring*, *Limestone*, *Sweet*, *Sulphur*, and *Chalybeate*. The most active ingredients in the first or main spring are sulphate of magnesia and carbonate of iron. The temperature of the water is 55° F., which must be somewhat higher than the common springs of this region.

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* The contents of this chapter may be found in the first part of the volume.

The Bedford waters have acquired deserved celebrity in indigestion and chronic diarrhœa and dysentery, and in renal diseases, in which the inflammation or inflammatory excitement has subsided, and there remains an atonic and enfeebled condition of the organs. In uterine and in cutaneous diseases which have reached this stage and assumed a chronic character, they are, also, of decided benefit. The gouty and rheumatic, in whom there is no plethora or cerebral determination, have also reason to speak well of these waters.

These prominent features of the Bedford Springs being premised, it may not be amiss to add a few particulars of their history and locality, and of their therapeutical value in some diseases not mentioned in the preceding paragraph.

The discovery of the remedial virtues of the Bedford waters only dates about half a century back. "In the year 1804 a mechanic of Bedford, when fishing for trout in the stream near the principal fountain, was attracted by the beauty and singularity of the waters flowing from the bank, and drank freely of them. They proved purgative and sudorific. He had suffered many years from rheumatic pains and formidable ulcers on the legs. On the ensuing night he was more free from pain, and slept more tranquilly than usual; and this unexpected relief induced him to drink daily of the waters, and to bathe his limbs in the fountain. In a few weeks he was entirely cured. The happy effect which they had on this patient led others, laboring under various chronic diseases, to the springs. In the summer of 1805, many valetudinarians came in carriages, and encamped in the valley, to seek from the munificent hand of nature their lost health." —*Gordon's Gazetteer of the State of Pennsylvania.*

The springs, with the exception of the chalybeate, are situated in Shover's Valley, which lies between Constitution Hill, on the east, and Federal Hill on the west. The valley is watered by Shover's Creek, which passes through it, and discharges itself into the Raystown branch of the Juniata River about a mile east of the town.

On the chief points which may be supposed to engage the attention of invalids visiting the Bedford Springs, Dr. Church* writes so pleasantly and so well that I shall use his language on the occasion rather than attempt a condensed description, which would not probably be so clear or satisfactory. The eulogy of the curative powers of the waters is strong, but judging from my own experience of their efficacy, in a variety of cases in which I have prescribed them in Philadelphia, it can hardly be deemed overwrought.

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* An Analysis of the Waters of the Bedford Mineral Springs.

The use of these waters is contraindicated in plethoric habits, with determination of blood to the head, or with abdominal congestion and a predisposition to active hemorrhages, or during a paroxysmal state of gout, even though it be the wandering kind, and, also, in subacute rheumatism. In early life, when a student of medicine, I used to listen to the personal experience of the effects of the Bedford water on a highly intelligent and observing gentleman, brother of the late Professor Benjamin Smith Barton. He said that on one occasion he visited the springs, and began to use the water when he was still excited and somewhat feverish by his journey, a condition of which he complained before he left home. The consequence was a sharp "bilious attack," of some days' duration. On another occasion, for he was a regular visitor to the springs, while laboring under a predisposition to the disease, he had an attack of gout, owing, as he believed, to his beginning to drink the waters before he was prepared by rest, regimen, and some cooling remedies. For the most part he returned home in greatly amended health, and enjoyed longer exemption from an attack of gout—a disease to which he was subject.

Dr. Church will now tell us about these famed waters.

"*Anderson's, or the Principal Spring*, issues in a very copious stream, from a fissure in a limestone rock, on the west side of Constitution Hill, about thirty feet above the level of Shover's Creek, and is situated within twenty yards of the verge of the bank of the creek. The water is clear, lively, and sparkling. At ten A. M., on the 28th of May, 1825, the temperature of the water in the spring was 58° F., while that of the surrounding atmosphere was 70° of the same scale. Its specific gravity is 1.029. It has a peculiar saline taste, resembling a weak solution of Epsom salts in water, impregnated with carbonic acid, and exhales no perceptible odor. On exposure in an open vessel to the air, it becomes vapid, but does not become turbid, or deposit a sediment. The water deposits carbonate of iron on those substance over which it constantly flows. Limestone, iron ore, calcareous and silicious substances, abound about the spring."

Analysis by Dr. Church.—"A quart of water, evaporated to dryness, gave *thirty-one* grains of a residuum. The same quantity of water, treated agreeably to the rule laid down by Westrumb, contained eighteen and a half cubic inches of carbonic acid gas. The residuum, treated according to the rules given by Dr. Henry, in his system of chemistry, gave the following result:—

	Grains.
Sulphate of magnesia, or Epsom salts	20
Sulphate of lime	3¾
Muriate of soda	2½
Muriate of lime	¾
Carbonate of iron	1¼
Carbonate of lime	2
Loss	¾
	31

To which must be added 18½ cubic inches of carbonic acid gas.

"*Fletcher's, or the Upper Spring*, issues from a fissure in a limestone rock, on the west side of Constitution Hill, about one hundred and fifty yards south of Anderson's Spring. It is also a copious spring. At ten A. M., on the 28th of May, 1825, the temperature of the water in the spring was 55° F., while that of the surrounding atmosphere was 70° of the same scale. The foregoing experiments, made on this water, gave rather more iron and common salt, less magnesia, and about the same proportion of the other substances. And the general observations made regarding Anderson's Spring, are equally applicable to this one.

"It gives me great pleasure to state that the foregoing analysis of these waters, confirms that made a few years ago by one of the first chemists of the nation."* They furnished, by this analysis, "1st. Carbonate of lime, with excess of acid. 2d. Sulphate of magnesia, or Epsom salts. 3d. Sulphate of lime, small quantity. 4th. Muriate of magnesia. 5th. Carbonated oxide of iron."

The Board of Managers of the Springs, in their circular letter, very justly observe that, from the results given, it is plain these waters must be laxative and tonic; and experience has amply proved that they possess these effects in a high degree. They give rise to full purging, and cause a discharge of bilious or other acrid matters with as much activity as the most powerful purgatives. They also excite the action of the kidneys and skin, causing a very free secretion of urine and perspiration.

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* Dr. De Butts, of Baltimore.

It is further stated that the Bedford waters, drank with proper precaution respecting quantity, temperature, diet, and exercise, and accompanied by the judicious use of the baths, are found to be salutary in a wide range of chronic diseases. In hepatic affections, in diseases of the stomach and intestines, in dyspeptic and hypochondriacal derangements, in hemorrhoids, and in all the varieties of intestinal worms, the water has effected numerous cures. In secondary diseases of the lungs, originating in the sympathies of those organs with the stomach and liver, the relief has been equally certain. In the diseases of the skin and of the kidneys, and especially in calculous and gravelly affections, they have been very efficacious. In rheumatism of weak excitement, in anasarca and various uterine diseases, such as obstructions of the menstrual flux, or its excess, fluor albus, painful menstruation, &c., many cures have been effected, and, failing in this, they have still been generally beneficial. In diabetes, and in certain forms of gout, they have been used with great profit. In the debility following the cure of acute diseases, and in the weakness consequent on the mercurial treatment of syphilis, the Bedford waters have been found to be good restoratives. In all those chronic affections, which are too often the consequence of acute diseases in southern climates, and especially in those called bilious, the waters, together with the bracing vigor of a mountain air, effect most happy changes.

"The solvents of the greater part of the substances held in solution by this water, being fixed ones, render it peculiarly fit for transportation, and it is carried away, almost daily, at a great expense, to the cities and neighboring states, where it produces its very beneficial effects."

The Limestone, or Lower Spring, is a very bold spring of pure limestone water, which issues from two or three fissures in a limestone rock, on the west side of Constitution

Hill, about two hundred yards lower on the creek than Anderson's Spring, and about forty feet below the level of that spring. It issues in sufficient quantities to turn an overshot mill. On the 28th of May, 1825, the temperature of the water in the spring was 51°F., and that of the surrounding atmosphere was 70° of the same scale.

"*The Sulphur Spring* rises on the west side of Shover's Creek, about two hundred yards distant from Anderson's Spring. It is a weaker spring than the others, and the water is covered with a thin whitish pellicle. The water exhales a very strong odor of sulphuretted hydrogen gas. Its temperature was 56° F., while that of the atmosphere was 71°. It has a peculiarly unpleasant hepatic taste, which I cannot well define. Chemical experiments, conducted in the same manner as those before detailed, prove that it holds in solution carbonic acid, sulphuretted hydrogen gas, small quantities of lime, magnesia, and common salt, and that it contains no *iron.*

"*The Sweet Springs* are two in number, and issue from fissures in slate rocks, about fifty yards apart, on the east side of Federal Hill, about one hundred and fifty yards distant from Anderson's Spring, from which they are separated by Shover's Creek. They are copious springs of remarkably pure water, which is very clear and colorless. Its temperature was, on the 28th of May, 52° F. Infusions of litmus and turmeric, barytes, nitrate of silver, carbonate of ammonia, and phosphate of soda, added after each other, muriate of lime and tincture of galls, effected no changes on this water. Lime-water rendered it slightly turbid. It is the purest water I ever saw, and all that is necessary to render it as pure as distilled water, is to expel the carbonic acid by boiling, after which it can be kept in well-stopped bottles, and used for the same purpose as distilled water. The water of these springs is used for cooking, washing, &c., by the residents at Bedford Springs; and the visitors decidedly prefer it for drinking water; and, on account of its purity, they very appropriately called these springs the *Sweet Springs.*

"*The Chalybeate Spring* rises in a meadow, about one and a half miles northeast of Bedford, and about three miles from Anderson's Spring. It is not a copious spring. The water exhales the peculiar odor of sulphuretted hydrogen gas, and is covered with a thin whitish pellicle. When first taken from the spring it is clear and limpid, but on exposure in an open vessel to the action of the air, it becomes turbid. Its taste is ferruginous and slightly hepatic. Experiments conducted as those heretofore detailed, prove that it contains carbonic acid, sulphuretted hydrogen, carbonate of iron, with muriate of soda, and a minute portion of magnesia. The spring is surrounded by a species of iron ore, called bog ore. A singular fact connected with the history of this spring is, that part of a skeleton of a mammoth was found when cleaning it out."

There are ample accommodations for visitors, both at the springs and in the town of Bedford.

"Houses for the cold, shower, and warm baths are erected, in which there is every accommodation for taking the baths, and an attentive and obliging bath-keeper takes charge of these establishments. The water that supplies the warm bath is conveyed from the Upper Spring, through a tunnel, which passes under the channel of Shover's Creek. The same tunnel supplies a trough for watering horses, and I was credibly informed that the use of the water cured the botts, the hide-bound, and other diseases of horses, and that that noble and valuable animal becomes remarkably fond of the water after drinking it a short time.

"To describe the serpentine and beautiful walks up Constitution Hill; the artificial lake of fresh water, on which small boats can plsasantly sail; the small artificial island in the lake, on which the managers intend to plant choice shrubbery, and the other improvements, would extend this lengthened paper so as to tire the reader. I shall, therefore, pass them without further notice, and conclude by observing, that, although I cannot say with Dr. Goldsmith, in his 'Deserted Village,'

'Here smiling Spring its earliest visit pays,
And parting Summer's lingering bloom delays;'

yet I can with great justice say, here nature has formed the scenery truly picturesque and romantic, and art has harmoniously combined with her in rendering it still more beautiful. Here, also, 'the chemist, the geologist, the mineralogist, the botanist, the landscape painter, and the general lover of nature, will find much to employ, amuse, delight, and reward attention, or beguile the tedium of valetudinary habits and distresses;'* and that the facilities for travelling to and from the cities, by turnpike roads, &c., good accommodations, scenery, climate, the efficacy of the waters, &c., all combine to render Bedford one of the principal watering places in the United States."

Dr. Caspar Morris speaks in high terms of the good effects of the Bedford water on himself, both at the springs and at home. He says:—

"The sensible action of the water of the 'Mineral Spring,' at Bedford, is on the kidneys, producing very prompt and profuse diuresis; on the skin, giving rise to very free perspiration; and on the bowels, causing gentle catharsis. It will thus be evident that all the emunctories are stimulated to increased activity; the discharges are copious, and yet not only is no debility induced, but there is an actual increase of vital force, in proportion to this activity. I have myself twice gone to Bedford, so prostrated as scarcely to endure the fatigue of the journey, and wholly disqualified for all exertion, and have in both instances returned, at the end of a fortnight or three weeks, restored to my wonted power of labor; and have witnessed similar results in the cases of friends and patients. This increase of energy cannot be justly attributed to the mere catharsis and diuresis, disgorging the portal circulation, and thus promoting digestion and assimilation; though, undoubtedly, much is due to this cause."*

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* Philad. Journal.

Dr. M. recommends the invalid to rise early, and, before dressing, to drink half a pint of the water in his room. Repairing to the spring, he will there drink another tumblerful of water, and repeat this process until five are taken at intervals of at least ten minutes. A brisk walk should be taken during each interval. "Two hours should be occupied in the drinking and walking before breakfast, during which time the skin and kidneys will pour forth an amount of fluid proportioned to the quantity which has been swallowed, and these secretions should be promoted by exercise adapted to the strength of the invalid. The quantity mentioned will generally occasion some three or four watery evacuations from the bowels, of a bright yellow color, without pain or exhaustion. Should this not occur during the two hours following breakfast, another glass should be swallowed before dinner; and in case the bowels should still resist the influence of the water, a dose of blue pill should be taken at bedtime, followed, in the morning, either by calcined magnesia, or the addition of Epsom salts to the water. I have never known the water to prove violently or painfully active, but in one person. In such an event the use of it should be suspended."

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* **Medical Examiner, June, 1852.**

Dr. Morris's experience is coincident with my own in favor of the utility of the Bedford water in sick headache. I have found it, also, of the greatest service in other cases of distressing nausea with gastralgic pains and constipation.

An analysis of the water undertaken by Dr. Cheston J., son of Dr. Caspar Morris, in the laboratory of Professor Booth, gave different proportions of the salts from those detected by Dr. Church. Dr. C. J. Morris found in a pint of the water 11.274 grs. of the sulphate of lime, and 3.974 grains of the sulphate of magnesia; whereas Dr. Church exhibits 20 grs. of this last salt, and but 3.705 of the sulphate of lime in a quart of the water. The chloride of sodium (muriate of soda), in Dr. Church's analysis, is 2.500 grs., and in that of Dr. Morris little more than a third of a grain. Iron was believed by the former to exist in the state of a carbonate, by the latter in that of a sulphate, together with sulphate of alumina ignored by Dr. C. Sulphate of soda, in the proportion of 3.092 grs., mentioned by Dr. Morris, does not appear in the analysis of Dr. Church. The entire amount of solid contents found by the latter gentleman was 31 grs., and by the former, preserving the same proportion of water, they would be 44.402 grs. The absence of carbonic acid in Dr. Morris's analysis is explained by the fact of his having examined the water in Philadelphia, at a distance from the spring, and hence an escape of the gas.

Within a day's ride of Bedford are the little town of Bath, in Virginia, and its thermal spring, of which further mention will soon be made.

Chalybeate Spring, near Pittsburg.—Within four miles of Pittsburg is this spring, which has been described and analyzed by Dr. Meade.

"When the water remains undisturbed for a few hours, it is covered with a white pellicle; its taste is lively and rather pungent, with a peculiar ferruginous flavor, and it exhales an odor of sulphuretted hydrogen gas. Its temperature is very generally uniform, and is of 54° F. The specific gravity of the water differs little from the purest water, and is as 1,002 to 1,000.

"According to Dr. Meade's analysis, it contains muriate of soda, 2 grains; muriate of magnesia, ½ grain; oxide of iron, 1 grain; sulphate of lime, ½ grain; carbonic acid gas in one quart of water, 18 cubic inches.

"Dr. M. thinks this water even superior, in a medicinal point of view, to the water of the *Schooley's Mountain Spring*, which has long sustained a high character for its chalybeate properties."

Frankfort Mineral Springs.—Dr. Church, many years ago, directed public attention to these springs.

"Cave spring, which is the most considerable, and to which there is the greatest resort, is very romantically situated within a large cave, on the farm of Mr. John Stevens, in Hanover Township, Beaver County, Pennsylvania, about twenty-six miles southwest of Pittsburg, and about one mile and a half northeast of the village of Frankfort. The cave is a great natural curiosity. It is excavated by nature out of a large hill, and is about sixty feet below the surface of the earth. It is overhung, and in some places arched over with large flat rocks, which are covered with calcareous incrustations, strongly impregnated with the sulphate of iron and alum.*

"The water of Cave Spring would seem, from the analysis of Dr. Church, to contain the following substances: Carbonic acid, carbonate of iron, carbonate of magnesia, sulphuretted hydrogen gas, muriate of soda, and a minute portion of bitumen.

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* Philadelphia Medical and Physical Journal.

"Leiper Spring, within a quarter of a mile of Frankfort, holds in solution rather more carbonate of iron and muriate of soda, less carbonate of magnesia, the same proportion of sulphuretted hydrogen gas, carbonic acid, and bitumen, than Cave Spring."

Dr. Church, in reference to the medicinal employment of the Frankfort water, tells us, that when first drunk it sometimes excites nausea and vomiting. For the most part, however, the water sits well on the stomach. Some individuals, not very wisely, have drunk two or three quarts in the course of an hour, without its causing any sensation of weight or coldness at the stomach. It generally operates two or three times on the bowels, and very copiously by the kidneys. In some persons it produces vertigo and slight intoxication. This water, to use the language of Dr. Church, "regulates the bowels, strengthens the stomach, improves the appetite astonishingly, clears the skin, promotes diaphoresis and great freedom of urination."

"Drinking the water, with the use of the cold shower-bath, has been of great service to persons laboring under chronic rheumatism, gravel, dyspepsia, asthma caused by gastric irritation, general debility of the system, and to convalescents from bilious fever and liver complaints. The use of the water alone has cured several cases of cutaneous affections, such as herpes, psora, &c." Dr. C. mentions his own personal experience of entire cure of bad hemorrhoids, with which he had been affected for years, after drinking the water during five or six days. Other persons had reported to him similar cases of entire relief.

York Springs.—They were formerly much visited, especially by citizens of Baltimore. One of them is saline; and consists of 1.20 grains of sulphate of magnesia, 6 grains of sulphate of lime, and 4 of muriate of soda in a pint of water. The other is a strong chalybeate. The water of the first is said to be diuretic and mildly cathartic. The chalybeate will, of course, produce the same effects as others of its class. This place is readily reached by railroad from Philadelphia and Baltimore. It is in Adams County, "two to four hours ride of Gettysburg, Carlisle, Harrisburg, and Hanover."

Perry County Springs.—These, erroneously called "warm," are so far thermal as to be, probably, 70° or 72° F., or fifteen to eighteen degrees higher than the common springs of the country; and hence the water would furnish a pleasantly cool, approaching to a temperate bath. When drank, they are said to have a gentle aperient and a decidedly diuretic effect. Cutaneous diseases have been cured by the baths. They are situated on the banks of Sherman's Creek, eleven miles from Carlisle, fourteen from Harrisburg, and the same distance from Duncannon on the Central Railroad, and at the foot of Pisgah Mountain, in a district which allows of fine drives and rides.

Carlisle Springs.—The water of these springs is a mild sulphureous one. They are within a short distance of the town of Carlisle, which is traversed by the railroad from Philadelphia to Pittsburg.

The house for the reception of visitors is said to be well kept.

Some springs of common water, such as

the "Hogshead Spring," remarkable for the extreme purity and coolness of its water, and Setart's Spring for its great volume, so that it turns two mills at its origin, merit the notice of a visitor to the Carlisle Springs. The same may be said of the Cave, on the banks of the Conedoguinit Creek.

Doubling Gap Sulphureous and Chalybeate Springs.—They are situated in a gap formed by the doubling of the Kittanny or North Mountain, about thirty miles southwest of Harrisburg, in Cumberland County. The Cumberland Valley Railroad passes through Newville, distant eight miles from the springs, to which visitors are taken by stages.

Professor Booth, of Philadelphia, writes respecting his analysis of the sulphur spring water as follows:—

"The odor of sulphuretted hydrogen, perceived at some distance from the springs, imparts to this water the peculiar properties of sulphur springs. Besides this ingredient, I find that the water contains carbonate of soda and of magnesia, Glauber's salts, Epsom salts, and common salt, ingredients which give it an increased value. After removing the excess of carbonic acid which it contains, it gives an alkaline reaction."

Of the other spring, he says: "The chalybeate water readily yields a precipitate after ebullition or continued exposure to the excess of carbonic acid. Besides the bicarbonate of iron, which is the chief characteristic, it also contains Epsom salts, common salt, and carbonate of magnesia."

With a knowledge of the constituents of these waters, and of the curative powers of the respective classes, sulphureous and chalybeate, to which they belong, it will be easy to indicate the diseases and the conditions generally in which they can be used with benefit. The precise dose, either with a view to their aperient or other modes of action on the economy, must be a matter of experimental trial at the springs.

Fayette Spring.—"In a deep glen on the eastern slope of Laurel Hill, and half a mile south of the National Road, is the Fayette Spring." So wrote a correspondent of the *North American and United States Gazette*, July, 1854. He adds: "The water is a chalybeate, very cold, and of copious supply. The attractions of the place are the wild scenery, and refreshing coolness and elasticity of the pure mountain air. Pittsburg, Wheeling, and the smaller towns nearer the place, furnish the six score visitors who, with none of the fashionable but deleterious luxuries of the great watering places, enjoy themselves more rationally. It often rains, too; so I marvel not that men leave the valleys to enjoy here the blessings of showers and dew, of lightning and clouds, of mountains and hills, and all green things of the earth."

Blossburg Mineral Springs.—The town is in the region of the bituminous coal and iron mines of Tioga County, which borders on the State of New York. It is connected by railroad with Corning, in New York, and by this latter place with the New York and Erie Railroad. It lies, also, about twenty miles west of the junction railroads between Philadelphia and Elmira. The cross-road is rough and mountainous.

The water of the Blossburg Springs, as far as I can learn from Dr. Edward Hartshorne, ranks them among the acid class. It probably contains, besides the excess of sulphuric acid, sulphates of iron and of alumina, with sulphate of magnesia, and possesses the same therapeutic value as other waters of this kind. Dose, a tablespoonful. There is a new and spacious hotel at Blossburg.

Bath Chalybeate Springs.—At one time these springs used to be visited by many of the citizens of Philadelphia, on account, in good part, of ready access to them. They are a short distance, half a mile, from Bristol, on the Delaware. Dr. Benj. Rush wrote a notice of them in 1773.

Besides these mineral springs of Pennsylvania now enumerated, there are cold springs of pure water, which, owing to their situation in a healthy and romantic district of country, and the facilities furnished for cold bathing, have acquired deserved vogue. Of these I shall notice—

The Yellow Springs.—They are in Chester County, thirty miles from Philadelphia, and are reached from this city twice daily by the Reading railroad and stages. The view of the surrounding country is fine, and facilities are given for excursions in different directions. In addition to the natural baths by immersion, shower and douching, of the temperature of the chief spring, which is 53° F., warm ones are also supplied. The house is well kept, and the table really good.

The Ephrata Mountain Springs.—These springs, situated in Lancaster County, are resorted to by large numbers of people every year. The scenery, the grounds around, the accommodations and means for baths of various temperatures, present strong inducements for visiting this spot.

Caledonia Springs.—To the inhabitants of the city who have suffered from the wear and tear of business, to the invalid slowly recovering from disease, to those who have become weakened and exhausted in the giddy round of pleasure, and to all who would like to see Nature in her nobler aspects, this spot is eminently inviting. A new scene and new associations of a genial and abiding character are opened to us, and, for a while, at least, we feel ourselves relieved from leaden cares, and enjoy a sense of unwonted freedom. While nature has been so bountiful in her mountain and woodland views, her pure and copious springs and streams, and a vivifying and exhilarating air, art has also contributed its share to the comforts of the visitors to this spot, who are received in a new, spacious, and well-ordered hotel, are comfortably lodged, and sit down to a table every way well supplied—the viands good, abundant, and prepared with due culinary skill.

The Caledonia, long known as Sweeny's Cold Springs, have enjoyed, during many years past, quite a reputation, when used as a bath, for the cure of chronic rheumatism and various other diseases in which there is blending of still remaining febrile heat and irritation, with debility. Warm baths also are always to be had.

The springs are situated at the foot of the South Mountain, which rises in the rear of the hotel, and in front they command an extensive view of alternate woods and fields, terminated by a semicircular sweep of the North Mountain. Temperature 52° F. Without meaning to undervalue the efficacy of mineral waters, the writer can recommend invalids or the weak, who wish to become stronger, to make the regular drinking of the singularly pure water of one of the springs, before breakfast and before dinner, a part of the pleasant regimen of good eating, sound sleeping, and varied exercise, which he will enjoy at this favored spot.

The reputation acquired during so long a period by the Malvern Springs in England, for the cure of a large number of diseases, may well be participated in by the Caledonia waters. Both of them are remarkable for their extreme purity, and both are applicable to the same curative ends when used as a bath and for drinking. The waters of Malvern sometimes purge, but more generally produce constipation—effects very analogous to those caused by a methodical drinking of the Caledonia waters. All of them have been found serviceable in chronic cutaneous disease, when used both externally and internally. I would refer the reader to what was said of the Clarendon Springs in Vermont for additional suggestions.

The Caledonia Springs are fifteen miles from Chambersburg; the greater part of the road being the turnpike which unites this town with Gettysburg. Visitors, on their arrival by railroad from Philadelphia or Baltimore, are taken out immediately in omnibuses or other vehicles from Chambersburg to the springs, which they reach in the evening of the same day of their leaving either of the cities just named.

The Brandywine Springs in Delaware, once much resorted to, are no longer visited for the purposes of health or pleasure; and yet few spots in the Union present greater attractions than these springs, in their elevated yet not too exposed situation, pure air, fine scenery and charming rides. They are within a few miles (eight, I believe), of Wilmington. The water of the chief spring is a mild chalybeate.

CHAPTER XI.

Virginia—Its numerous mineral and thermal springs—Bath (Berkley County)—Jordan's White Sulphur Capon—Fauquier or Warrenton—"Virginia Springs"—The Bath Alum—Rockbridge Alum—Volcanism and Thermalism—The Warm Springs—The Hot Springs—Group of Sulphur Springs—The White Sulphur.

VIRGINIA is peculiarly rich in mineral springs, and, until the acquisition of California and New Mexico, had more thermal ones than any other portion of the United States. Beginning with those in the north and advancing to the south, we first meet with—

The BATH (Berkley County) SPRING.—This is a mild carbonated thermal water of the temperature of 73° F., the same as that which in England, by a strange blunder, is called Bristol *Hot Well.* It has been very serviceable in a variety of chronic diseases, when used as a bath. Persons who went there crippled with chronic rheumatism have come away quite restored to the free use of their limbs, and as agile in all their movements as the country people around. The internal use of the water, which holds in solution some of the salts of lime and magnesia, merits more attention than it has generally received, especially in atonic and irritable dyspepsia and chronic bowel diseases. In irritable bladder and the tendency to lithic acid deposits it will also be found useful. The dose of the Bristol, or, as it is now called, Clifton water, is two half pints, with some interval between them, before breakfast, and the same quantity between breakfast and dinner.

Bath is within a short distance of the Baltimore and Ohio Railroad, if we are not mistaken; and, as already stated, it is not far from Bedford, Pennsylvania. The hotels are well kept.

Shannondale Saline Springs.—These springs are within a few miles of Charlestown, Jefferson County, through which the railroad from Harper's Ferry to Winchester passes. There visitors take stages, and, after a ride of five miles, are at the Springs. The water acts as a mild aperient and diuretic, and is adapted, in consequence, to a large circle of diseases in which a gradual reducing process of chronic inflammation and irritation is gone through without pain or annoyance, and with an improvement of the appetite and general strength. The springs are near the banks of the Shenandoah River, the sound of whose waters is heard with an agreeable effect at the hotel on the hill where the visitors are quartered. There are few spots in the Union which present so many natural advantages and capabilities for extended walks, gardens, and groves as Shannondale.

JORDAN'S WHITE SULPHUR SPRINGS.—They are about five or six miles from Winchester, and two miles from the railroad between this town and Harper's Ferry. Passengers leaving Baltimore in the morning will reach the springs about three in the afternoon. The waters are serviceable in chronic dyspepsia with a torpid state of the liver, chronic rheumatism, cutaneous affections, and the debility left by fevers.

Many of the visitors to the upper or mountain springs in the southwestern part of the State, spend a few days here on their return to the north; and those from the Eastern Shore and Northern Neck linger late in the season, until it is safe for them to go home, with a prospect of escaping an attack of their endemic fevers.

CAPON SPRINGS.—These have come greatly into vogue of late years, and, as it would seem, not without good reason. The water is beneficial in certain forms of dyspepsia and in renal affections, especially, as we are told, in the lithic acid diathesis. The arrangements for cold bathing are on a large scale, and the baths of a superior kind. Warm bathing can also be enjoyed by those who claim it, either as a hygienic agent or a remedy in disease. Mountain air largely inhaled gives a keener relish for the mountain mutton, of which the lovers of good cheer speak so highly at this place. A hotel of the first class has been erected, and furnishes good quarters to a large number of visitors. Not a few have their own houses and cabins.

The Capon Springs are about thirty miles from Winchester. Whether for fear of diminishing the reputation of the water as a medicinal agent, by showing how very slight is its mineral impregnation, or owing to the indolence of the parties more directly interested in the question, we cannot say; but, as yet, there has been no analysis made, or, at any rate, reported, which has come under my notice.

FAUQUIER OR WARRENTON WHITE SULPHUR SPRINGS.—They derive their first name from the county, the second from the town near to which (six and a half miles) they are situated. They are thus within a few miles of the railroad from Alexandria to Warrenton, and at the same distance to the one from Staunton *via* Gordonsville, which traverses the valley; and they are reached by stages from Winchester.

The waters are of a mild sulphureous nature, but of the proportion of their gaseous and solid contents we are ignorant. Numerous cases are recorded of their efficacy in dyspepsia, chronic diarrhœa and chronic rheumatism, also in renal affections and disorders of females, but without very minute specification of the organic lesions in these latter.

Superior attractions to those of the waters are offered to the crowd of visitors in a noble mansion as a hotel, extensive and tastefully arranged grounds, ornamented with shrubberies and parterres. In addition to the main building or pavilion, which has a portico on its western front commanding a view of the lawn and an extensive picturesque region beyond, there are several brick buildings of a large size. Ample provision is made for all the varieties of bathing.

Traversing the beautiful and fertile region, known as the Valley, between the Blue Ridge and the Alleghany Mountains, which begins at Harper's Ferry, and ends at the Natural Bridge, south of Lexington, we find ourselves in the region of the celebrated "Virginia Springs." We know of no part of the world, of the same extent, which is marked by such a number and variety of mineral and thermal springs as the one now under notice. It possesses, at the same time, the advantages of a fine climate and scenery of a highly diversified character. The company at the several springs, free from aristocratic pretensions and ridiculous attempts at exclusiveness, always exhibits a large share of intelligence, good taste and sociability. The infusion of the Virginian or southern element—a frank, cordial address and good humor—adds not a little to the pleasures of the northern visitors, who, with excellent intentions, are not remarkable for that ease of manner and confiding speech which invite intimacy.

Leaving Staunton, with a design to visit the "springs," we shape our course west, and at a distance of forty-five miles in that direction, we reach—

The Bath Alum Springs.—They are on the main road from Richmond to Guyandotte on the Ohio River, at the eastern base of the Warm Spring Mountain, and a few miles east of these springs on the direct road from Staunton to the White Sulphur Springs.

An analysis of the water of one of the Bath Alum Springs, that most used, by Dr. Hayes, of Boston, shows it to contain, in a gallon, nearly fifty-five grains of saline substances, and of carbonic and sulphuric acids. Those most active are the salts of iron and alumina, and on them and the free sulphuric acid, the sensible properties and curative powers of these waters in a great measure depend. Being a strong tonic and astringent, it is easy to indicate a number of diseases in which they must be of service, and, already, experience has proved in many respects what *à priori* reasoning would have suggested respecting their beneficial operation. We may specify, as first on the list, chronic affections of the digestive mucous membranes, including those of the throat, stomach, and bowels, and marked by feebleness or imperfection of function and morbid secretions. Similar praise may be extended to it in chronic rheumatism, chronic diseases of the urinary and generative organs, and cutaneous diseases. Chronic ulcers, simulating cancers, and scrofula have been greatly relieved, and in some cases entirely cured by the methodical drinking of these waters—a result quickened by their external application to the sore or tumor.

The accommodations for the reception and entertainment of visitors are represented to be of a superior kind at these springs.

Rockbridge Alum Springs.—If, in place of turning off west from Staunton, we were to go further south, to Lexington and the Natural Bridge, and then visit the Warm Springs, we should meet with these alum springs on the road. They are seventeen miles from Lexington, thirty-three from the Natural Bridge, and twenty-two from the Warm Springs, by way of the Bath Alum ones, in a valley between the North Mountain on the east and the Mill Mountain on the west.

The composition of the waters of these springs, as ascertained by Dr. Hayes, is similar to that of the Bath Alum Waters, and both of them resemble those of the Oak Orchard Springs in New York. The Rockbridge water is stronger in the proportion of free sulphuric acid and the sulphate of alumina, but contains less iron than the Bath waters. Its use is applicable to the same diseases in which the other is beneficial, with the modifications required by the differences in chemical composition just now stated.

The following are the analyses of the two springs by Dr. Hayes:—

In order to show at a glance the comparative composition of the two springs described, I give them in a tabular form.

In a gallon of the water are found—

	Rockbridge.	Bath.
Sulphate of potash	1.755	0.258
" lime	3.263	2.539
" magnesia	1.763	1.282
" protoxide iron	4.863	21.776
Alumina	17.905	12.293
Crenate of ammonia	0.700	1.776
Chloride of sodium	1.008	
Silicic acid	2.840	Silicate soda, 3.150
Free sulphuric acid	15.224	7.878
Carbonic acid	7.536	3.846
	56.867	54.798
Pure water	58315.133	58317.202
	58372.000	58372.000

Volcanism and Thermal Springs.—Now that we are approaching the region of thermal springs, it will be well to inquire into their geological relations, and to see whether here, as in so many other parts of the world, they are not associated with faults, and other evidences of disturbance and disruption, by which the strata have been converted from their horizontal position, into sharp angles and breaks. Changes of this nature, evincing the operation of a deep-seated cause, usually referred to igneous or volcanic forces, were alluded to when speaking of the gaseous and thermal springs of New York.

Primitive mountain chains, although they may not present on their surface volcanic products, bear undoubted marks of igneous origin, and of having been upheaved during a period of the greatest activity of what may be called general volcanism. Professor Forbes, of Edinburgh, in his visit to the springs of the Pyrenees, has shown that the majority of those of a thermal character, gush out at or near the line of junction between the granite or other igneous products, and the stratified rock, resting upon its flanks. "In a great many instances it happens that part of the springs rise from granite, and part from the slate or limestone in connection with it." Thus, as Dr. Daubeny remarks, the same agent which forced up the granite through the axis of the chain, may have given rise to the hot springs which accompany it, just along the line of disruption. He points out a similar geological character of the rocks whence issue the thermal waters of Dauphiny, Savoy, Valais, and Upper Piedmont, and, also, the interesting fact of the contiguity of some springs to remarkable dislocations of the strata. Examples of this nature are presented at Aix, Carlsbad, Pfeffers, and other thermal springs in Switzerland; and at Clifton and Matlock, in England.*

These views are strongly corroborated by the situation of the thermal waters in the beautiful mountain region of Western Virginia, which Dr. D. visited in 1838. Dr. Wm. B. Rogers has given his views on the subject in a paper entitled "The Connection of Thermal Springs with Anticlinal Axes and Faults." In common with G. Bischof, Dr. R. believes that the expletive, thermal, is applicable to springs whose temperature exceeds that of the atmospheric mean of the region in which they are situated. He then expresses his conviction, based on his own observations made from time to time, during a period of eight years, that a great proportion of the copious and constant springs of the vast belt of mountains occupied by the

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* Description of Active and Extinct Volcanoes, of Earthquakes, and of Thermal Springs.

Appalachian range, especially those of the great limestone valley of Virginia, "are truly, though slightly, thermal, and that they owe to a deep subterranean source, the remarkable uniformity of temperature they exhibit." His notices on the present occasion are, however, restricted to those which are decidedly and unequivocally thermal.

Of the *fifty-six* springs enumerated by Dr. Rogers, embracing *twenty-five* distinct lines, and individual localities, situated in various and remote parts of the valley, and the mountainous belt adjoining it, on the northwest, making, in all, an area of about fifteen thousand square miles, *forty-six* springs are situated on or adjacent to anticlinal axes, *seven* on or near lines of faults and inversion, and *three*, the only group of this kind yet known in Virginia, close to the point of junction of the Appalachian with the Hypogene (primitive) rocks.

This author thinks himself justified in announcing the prevailing law in reference to the more decided thermal springs of Virginia; and he believes that in the other parts of the Appalachian belt, *they issue from the lines of* *anticlinal axes*, or *from points very near such lines.* He introduces sections with suitable explanations confirmatory of the above views, and at the same time imparting just conceptions of the geological structure of the districts in which the thermal waters are situated.

The celebrated White Sulphur Spring is regarded by Dr. Rogers as decidedly thermal, for, although fluctuating in temperature, its waters, he thinks, never indicate less than ten degrees above the atmospheric mean.

While agreeing in some respects with the views so ably advocated by Dr. Daubeny, in relation to the evolution of the gases, and to other matters associated with thermal waters, the Virginia professor is not, by any means, prepared to adopt the hypothesis of the chemical action of the metallic bases of the alkalies and earths, nor to accede to the opinion that the heat of our thermal springs, as well as that of the rocks from which it is directly derived, is due to what is usually termed volcanic action.

In explaining the phenomena of thermal waters, we ought, he very properly argues, to try and do it by explaining the *chemical properties of the rocks*, in connection with a generally diffused *internal heat*. He directs attention to the almost *entire absence, over the vast surface of the Appalachian region, of igneous or volcanic rocks;* and sees in the peculiar position of our thermals in reference to axes, simply *those mechanical conditions which favor the access of air and water to the deeper seated, and, therefore, hot strata in the interior, and their expulsion at the surface.*

As bearing on the subject now before us, it may be well to state, for the information of the reader, that, as we learn from Captain Newbold, a majority of the springs of India which can be strictly called thermal, occur at or near lines of great faults, occasioned by the upheaving of plutonic rocks. A similar remark may be extended to some of the hot springs of Asia Minor.

Warm Springs.—They are situated in a valley in the county of Bath, between two ranges of mountains, one hundred and seventy miles from Richmond, and fifty from Staunton, on the turnpike road which leads to the Ohio. There is not a more delightful natural warm bath to be found in any part of the world than is obtained in the reservoir which receives the water of the chief spring. Its temperature, at first 98° F., is soon reduced to 96°; and for mere luxurious enjoyment it would merit a visit from Hudson's Bay, not to speak of Canada or New England. The large bath is of an octagonal form, 38 feet in diameter, and, on an average, five feet deep. Nitrogen is largely evolved, and in small quantities carbonic acid and sulphuretted hydrogen gases. The solid contents are in small quantity; not twenty four grains in a gallon of the water. In addition to the large octagonal bath, there are now a ladies' bath and a spout bath, and also a cold plunging bath near the chief warm one. The quantity of water given out by the warm spring has been estimated to be a thousand gallons a minute.

All that has been said of the enjoyment from warm bathing, and its utility in a long list of diseases, is applicable to the external use of the Warm Spring water. Adequate attention is not paid to the systematic use, internally, of this water, which, although possessed of little mineral strength, might be made a powerful and an efficacious auxiliary to the bath. In plethoric and inflammatory states of the system, and with a tendency to cerebral determination and excitement, caution must be displayed in the large or prolonged employment of this double remedy; for, although the temperature is such as to bring it within the limits of the warm bath, it comes so near the hot as to prove, in some cases, a stimulant, and, as such, it is not to be trifled with under the circumstances just mentioned.

The house at the springs is one of the best.

If we wish to appreciate at their full value the remedial virtues of methodical bathing at the "Warm Springs" in Virginia, we ought to learn the results from long and recorded experience of the use of the bath of nearly the same temperature at the warm springs of Wildbad in Germany. On this point I have written elsewhere, in some detail, as the reader may satisfy himself by reference to my volume on *Baths and the Watery Regimen*, in which will be found an enumeration of the diseases successfully treated by a course of bathing at Wildbad. Objection will not, I suppose, be made to my repeating, in part, what is said in that work.

"Paralysis, both of the lower extremities and of one side of the body, has been, in many cases, entirely removed by a course of bathing at Wildbad. Before any amelioration takes place, the patient generally experiences some pricking pains and tinglings in the paralyzed parts, followed by a sense of heat, perspiration, and increase of feeling. To these symptoms succeed a gradual restoration of muscular power, accompanied by a sense of electrical shocks passing along the nerves.

"Paralytic persons, of a full or plethoric habit, or whose circulation is active, should watch the effects of the warm bath, and make, at first, but moderate use of it.

"The baths at Wildbad are lauded for their remedial powers in affections of the joints, white swellings, and contractions; and, also, in lumbago and sciatica.

"Diseases of the skin are, in a more especial manner, overcome by these baths. Those specified are, herpes, prurigo, ptyriasis, acne, inveterate itch, fetid perspirations, &c.

"The baths at Wildbad, conjoined with the internal use of the water, at a temperature of 92° F., are efficacious in scrofula and chronic affections of the glands generally, including enlargements of the liver, spleen, and mesenteric glands.

"The water of Wildbad, like that of Wisbaden and Leuk, may be regarded as a pure thermal water.

"In chlorosis and sterility, not depending on organic affections of the uterus or ovaries, the Wildbad baths have displayed excellent effects.

"'The Wildbad baths are celebrated for the removal of those various pains and aches which not seldom attend old gunshot and other wounds. A case is related of an officer who had been wounded in the arm by a musket-ball, in the late war, and who was harassed by pains in the site of the wound many years afterwards. The use of the Wildbad baths reopened the wound, from whence a piece of flannel was discharged, and the pain ceased.'*

" *Counter-indications to the use of the Warm Bath.*—From its effects in retarding the circulation, the warm bath is not adapted to the plethoric, nor to those suffering from active congestion of the great viscera, or from hemorrhage, which is so generally associated with congestion. Hence, its use is not proper for the apoplectically disposed, nor for those who labor under cardiac aneurism, or a varicose state of the vessels generally. The habitually feeble, and they who have been weakened by violent disease, will, also, avoid the warm bath, unless they have, at the same time, a febricula or febrile irritation, which this remedy will remove. The tonic effects which I attribute to the warm bath, are indirect, and depend on its abating excessive excitement or irritation, and unless these states are present, its contra-stimulant action will only increase the existing debility.

"In all cases of doubtful propriety, or in which a trial is about to be made of the warm bath, as a means of cure, the immersion, at first, should be for a brief period—five to ten or fifteen minutes."

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* Johnson—Pilgrimages to the Spas, &c.

And again I have said, "At our own, as at the German thermal springs, the good effects of the bathing may be increased by drinking of the water, which is slightly laxative and diuretic, and more evidently diaphoretic.

"Making some allowances for a lively imagination, Dr. Granville's* account of his sensations in the bath at Wildbad, may very well be received as descriptive of those enjoyed by a bather in the Warm Springs of Virginia. He writes as follows: 'After descending a few steps from the dressing-room into the bath-room, I walked over the warm soft sand to the farthest end of the bath, and I laid myself down upon it, near the principal spring, resting my head on a clean wooden pillow. The soothing effect of the water as it came over me, up to the throat, transparent like the brightest gem or aquamarine, soft, genially warm, and gently mur-

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* Spas of Germany.

muring, I shall never forget. Millions of bubbles of gas rose from the sand, and played around me, quivering through the lucid water as they ascended, and bursting at the surface to be succeeded by others. The sensations produced by these, as many of them, with their tremulous motion, just *effleuraient* the surface of the body, like the much-vaunted effect of titillation in animal magnetism, is not to be described. *It partakes of tranquillity and exhilaration; of the ecstatic state of a devotee, blended with the repose of an opium-eater. The head is calm, the heart is calm, every sense is calm; yet there is neither drowsiness, stupefaction, nor numbness; for every feeling is fresher, and the memory of worldly pleasures keen and sharp.* But the operations of the moral as well as physical man are under the spell of some powerfully tranquillizing agent. It is the human tempest lulled into all the delicious playings of the ocean's after-waves. From such a position I willingly would never have stirred. To prolong its delicious effects, what would I not have given! but the badmeister appeared at the top of the steps of the farther door, and warned me to eschew the danger of my situation; for there is danger even in such pleasures as these, if greatly prolonged.

"'I looked at the watch and the thermometer before I quitted my station. The one told me I had passed a whole hour in the few minutes I had spent according to my imagination, and the other marked 29½° of Reaumur, or 98¼° of Fahrenheit. But I found the temperature warmer than that, whenever, with my hand, I dug into the bed of sand, as far down as the rock, and disengaged myriads of bubbles of heated air, which imparted to the skin a satiny softness not to be observed in the effects of ordinary warm baths.'"

At Leuk, or Loeche, in the Valais, four of the baths supplied by hot water, from 112° F. to 124° F., are brought down to the temperatures respectively of 95°, 96°, 98°, and 99° F. In them a number of bathers of both sexes, suitably attired after a strictly regulated costume, spend hours at a time, engaged the while in conversation, reading, chess, sewing, taking tea, &c. Counting the two periods of bathing, the first in the morning and the second in the afternoon, the whole time spent in the bath daily is from two to eight hours. The ordinary period of bathing, or *cure*, as it is called, is twenty-five days. Two or more seasons are often deemed requisite for a single cure. The water is used internally as well as externally, sometimes in conjunction with the bath, sometimes by itself. The time of drinking is in the morning, fasting. The quantity drunk is from two to ten glasses, with an interval of between ten and fifteen minutes between each two.

There are eighteen or twenty large public baths, varying in size from eight feet by eleven, to eighteen by thirty, and each capable of containing from fifteen to thirty-five persons, according to its size. Smaller ones hold from four to six.

It may be a question how far the leukerbad should be imitated in our thermal springs, by invalids laboring under a certain class or classes of infirmities and disorders. I have mentioned, in my volume, other places in which this bathing in company is practised. A description is also given of the plan of

Pomme, who directed his patients to spend many hours a day in the bath. I shall not repeat here what was said in that work of the several diseases for the cure of which the warm bath is resorted to.

In dwelling on the luxurious and salutary effects of the bath at the Warm Springs, we must not forget the internal use of the water, to which allusion has been already made. It acts on the skin, kidneys, and glandular organs generally, and in this way, with the addition of a slight aperient operation, it operates as a gentle but efficient alterative in irritable as well as in atonic dyspepsia, and restores suspended, and removes perverted secretions, as well hepatic and uterine as cutaneous. To derive the fullest effects from the water as a drink, its use in this way ought to be aided by the bath. The quantity will vary from two (half-pint) glasses to six or even eight glasses daily.

A cold bath plentifully supplied, adjoining the gentlemen's warm bath, allows of transition bathing, of which I have spoken in my other work *On Baths*, &c. Sometimes, for hygienic comfort, sometimes in disease under suitable directions, this plan merits occasional trials. The fever of reaction from bathing in the Wildbad water, spoken of as a matter of course by most German and some English writers on the "Spas," has been too much dwelt on. We are not to look for its frequent occurrence in our "Warm Spring" baths.

Hot Springs.—These springs are situated five miles west of the Warm, and in the same county of Bath. The hotel and cabins have little in their appearance to recommend them, but the table is good. The water of the baths—six in number—is from 98° to 106° F., and it is so distributed as to allow of its use by immersion in the common way, and by the douche or spout. Dr. Goode, the proprietor, exercises a general supervision. As no person in his senses ought to take a *hot* bath, in common health or for mere pleasure, these waters are resorted to by the sick and invalid, and hence there is not the crowd at the Hot which is so common at the other springs, especially the White Sulphur.

They are too powerful to be had recourse to except under medical guidance. As excitants of the first class, they are only adapted to diseases of functional debility, without inflammation or active congestion, or fever. In chronic rheumatism and gout, and in chronic stomachic and intestinal diseases, in which the circulation is languid and the skin cold or clammy, and tongue moist, and there is an absence of thirst, the hot bath and hot douche and drinking the hot water display, often, wonderfully restorative powers. So, also, in tumid livers and spleens after a subsidence of fever and phlogosis, in paralysis where the brain has recovered its functions, and in stiff and anchylosed joints and indolent and scrofulous tumors, old ulcers and chronic diseases of the skin, especially of the scaly kind, these means deserve a full trial. The application of hot water by douching adds greatly to its power.

Nine-tenths of the patients who resort to hot bathing at Bath, England, the temperature of the water being upwards of 100° F., are paralytic. Of these, more than two-thirds are either cured or receive great benefit. All these patients were bathed twice a week, and many of them three times. The mode of bathing consisted in immersion, and douching with the aid of thorough friction and shampooing. The exciting and diaphoretic effects of the bath are greatly increased by drinking the water. Hot douches or spout bathing is an important variety of the hot bath, and adds greatly to its effects, whether for good or evil.

The internal use of the water of the Hot Springs, like that of every other hot water, is attended with excitement of the circulation and nervous system, amounting to a kind of inebriation. Often it will be found, when drunk in the quantity of half a pint to a pint in the evening, to induce sleep in the previously wakeful and restless. Where a general stimulant is required, the effects of which we can, in a great degree, measure in advance, this water may be had recourse to with great advantage—as, for example, in gastralgia and enteralgia, in weakened states of the stomach and bowels without fever or inflammation, and often accompanied by chronic diarrhœa and dysentery, and especially if the skin be habitually cold at the same time. The free use of hot water as a drink, aided by the warm and on occasions the hot bath, will replace, to the great comfort and lasting benefit of the patient, all the drugs from the shop. Not only by its direct action on the digestive canal, as a mild aperient, but also by secondary action on the skin as a diaphoretic, will it give early relief and often entirely cure these diseases. In other cases, where no pains are taken to aid its diaphoretic operation by external warmth, it determines to the kidneys and increases their secretion. As a diluent and a soothing stimulant it will be often found of service in paroxysms of calculous disease, both renal and vesical, and particularly of the lithic acid variety. Dr. Falconer, in speaking of the Bath water as a drink, calls it antispasmodic, attenuant, antacid, expectorant and emmenagogue, sometimes inducing constipation, sometimes acting as an aperient; and he extols its use in diabetes when all other medicines, even the astringents had failed; also in dropsy from suppressed perspiration, and in hepatic obstructions, including those from biliary calculi.

A period of a month to six weeks would be required to give full effect, in many diseases, to the use of the Hot Spring water by drinking and bathing. The quantity to be taken as a drink will vary with the case and the degree of excitement following its use. As an alterative, from three to six half pints in the day, taken before meals and in the evening, will be sufficient. As a diaphoretic, to produce copious and continued sweating, with confinement of the patient to bed, it may be drunk more freely. The use of this water is contra-indicated in hypertrophy of the heart, aneurism, general and especially cerebral plethora, in hemorrhages actual or threatened in either sex, and in inflammation or fever of any violence; also during pregnancy.

THE GROUP OF SULPHUR SPRINGS.

On leaving the Hot Springs, the traveller reaches, after a journey of thirty-five miles in a southwestern direction, the White Sulphur Springs; and if he continue on westwardly, he comes to the Blue Sulphur, distant twenty-two miles from the White. The Salt Sulphur Springs are twenty-four miles southwest from the White, and the Red Sulphur are seventeen miles farther on in the same direction. This is not the place to speak of the geological relations of these several springs, nor to inquire how far they are all referable to the class of what have been called, of late, by some, Secondary or Accidental Sulphureous Springs, in contrast with those of the Pyrenees, chiefly thermal, by the way, which alone are thought to belong to the class of the Natural or Primary Sulphureous. For the latter has been claimed a therapeutic energy by no means proportionate to the amount of their constituent principles; and hence some of them, with only a half or even a fourth of those contained in the secondary class, will, we are told, display much more curative power. These are points on which I can only enlarge with advantage in my larger work.

Whatever result may be reached in an inquiry of this kind, no one can contest the really curative virtues of the waters of this entire group; at the same time, no one will deny that they are all endowed with such therapeutical energy that they must be either beneficial or mischievous, according to the wisdom of the prescriber in adapting their use to meet the requisite indications. No visitor at a sulphur spring can gorge himself with the waters, for experiment or amusement, with impunity. In fact, few remedies are as diffusive in their action on the animal frame, or as searching and alterative on the tissues, as the sulphureous. But, in order to produce their full and salutary effects, they ought to be administered in quantities, or doses, of moderate strength and for a lengthened period, and in that state of dilution in which they are found in mineral springs. By this means we shall avoid, in a great measure, that excitement and disturbance of function, resulting from the common indiscriminate use of the waters, which not seldom constitutes a disease itself, or brings back with aggravation the original malady they were intended to remove. Some, particularly the German physicians, insist on the necessity of a morbid reaction of this kind, which they call bad-storm or commotion, especially after the prolonged use of baths of a high temperature. Were we to admit this, it ought to be regarded as a conclusive reason for a longer time being taken and greater patience displayed by the invalid, and more watchful superintendence on the part of the physician, than are conceded for the treatment of a case of chronic disease at any of the sulphur springs. To do full, we ought rather to say common, justice to such a case, the methodical and regular use of the bath, together with drinking of the water, must be enjoined.

White Sulphur Springs.—Experience has pretty well established the fact of the water of the *White Sulphur Springs*, on Howard's Creek, the original White Sulphur of Greenbrier County, being the strongest, most active, and stimulating, and therefore, when misapplied, the most mischievous of the group, and the one which requires the greatest caution in its use. These matters will be regulated by physicians on the spot. Among them, Dr. Moorman has given us the result of his now somewhat long experience of the remedial value of the White Sulphur water, in a small volume, entitled *The Virginia Springs.* He, or some other permanently resident physician, ought to be consulted by all the invalids, who propose to make use of the water of the White Sulphur. The temperature of this water, 57°, as stated by some, and 62°.F., according to Dr. Moorman, is several degrees higher than that of the common springs of the district, and makes it rank, in strictness, in the thermal class.

The chief, or the White Sulphur Spring, is at an elevation of two thousand feet above the level of the ocean. "It bursts with unusual boldness from rock-lined apertures, and is inclosed by marble casements five feet square, and three and a half feet deep." It yields, continues Dr. Moorman, about eighteen gallons per minute; and it is a remarkable fact that this quantity is not perceptibly increased or diminished during the longest period of wet or dry weather. While other springs of the country have failed during the long draughts of summer, this has invariably preserved "the even tenor of its way."

"The water is most clear and transparent, and deposits copiously, as it flows over a rough and uneven surface, a *white*, and sometimes, under peculiar circumstances, a *red* and black precipitate, composed in part of its saline ingredients. Its *taste* and *smell*, fresh at the spring, are that of all waters strongly impregnated with sulphuretted hydrogen gas. When removed from the spring, and kept in an open vessel for a sufficient length of time for this gas to escape, or, when it has been *heated* or frozen for this purpose, it becomes essentially *tasteless*, and *inodorous*, and could scarcely be distinguished either by smell or taste, from common limestone water. Its cathartic activity, however, is rather increased than diminished when thus insipid and inodorous.* It does not lose its transparency by parting with its gas, as many other waters do; nor does it deposit its salts in the slightest degree when quiescent—not even sufficiently to stain a glass vessel in which it may be kept.

"The gas of this spring is speedily fatal to some animals, when immersed even for a very short time in its waters. Small fish thus circumstanced, survive but a few moments; first, manifesting entire derangements, with great distress, and uniformly die in less than three minutes."

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* See Chapter V.—On "The relative virtues of the saline and gaseous contents of the White Sulphur water."

The analyses of the White Sulphur water, by Dr. Hayes and Prof. Wm. B. Rogers, would not induce, *à priori*, a very great confidence in the therapeutical activity of these waters. The proportion of solid contents in the analysis by Dr. Hayes, of a pint of the water, is 16.57 grains; and in that by Prof. Rogers nearly the same; of which the sulphate of magnesia makes 4.32 grains in the former, and about 3 grains in the latter analysis.

Dr. R. finds about 1.5 grains of sulphate of soda, Dr. H. none. The largest ingredient is the sulphate of lime, being about 18 or 19 grains. The carbonates of magnesia and lime, and the chlorides of magnesium, calcium, and sodium, are in very minute proportions, or small fractions of a grain, in a pint of the water examined by Dr. Rogers. Dr. Hayes makes no mention of the chlorides of calcium or of sodium, nor of the protosulphates of alumina or of iron, found by Dr. R.; but he reports silica and the silicates of potash, soda, and magnesia, and a trace of iron.

As regards the gaseous contents, one is surprised to find such a minute proportion of sulphuretted hydrogen, very little more than a quarter of a cubic inch in a gallon of the water, according to Dr. Hayes, and not more than from 1.40 to 2.75 cubic inches by Dr. Rogers's analysis. Carbonic acid was in the proportion of 11.290 by the former, and 7.75 by the latter of these gentlemen's analysis. Iodine combined with sodium and magnesium has been found by Dr. Rogers, who reports also azotized organic matter blended with a large proportion of sulphur.

Had the matter been undertaken by less able analytical chemists, we might suppose that there exists in the water a sulphuret, say of sodium, still undetected, which might give some explanation of the clinical results obtained by its methodical use.

Having dwelt with some care on the remedial value of sulphureous waters, both internally and externally, when speaking of those of New York, I shall not go over the ground again here; but would refer the reader to what was said on that occasion, as applicable to his guidance at the White Sulphur and most of the other sulphur springs of Virginia. I cannot, however, forbear, even though it may involve some repetition, from introducing Dr. Moorman's sensible remarks on the use of this water, to the effects of which he has directed his attention for some years past:—

"All mineral waters, as before remarked, are stimulants to a greater or less degree, and consequently are inapplicable to the treatment of acute, or highly inflammatory diseases. This remark is especially true as relates to the White Sulphur, particularly when drank fresh at the spring and abounding in its stimulating gas. It is true, as before shown, that when its exciting gas has flown off, it becomes far less stimulating, and may be used with safety and success in cases to which, in its perfectly fresh state, it would be totally unadapted. But even in its least stimulating form, it is inadmissible for excited or febrile conditions of the system; and especially in cases of inflammatory action; at least, until the violence of such action has been subdued by other and appropriate agents.

"It is to chronic affections of the organic system that the White Sulphur water is peculiarly applicable.

"Various diseases of the stomach, liver, spleen, kidneys, and bladder, as well as some derangements of the brain and nervous system generally, are treated successfully by this agent. To the various affections of the skin, unattended with active inflammation; to chronic affections of the bowels, and to gout and rheumatism it is well adapted. In hemorrhoids, in some of the chronic affections of the womb, in chlorosis and other kindred female disorders, in mercurial sequelæ, and especially in the secondary forms of lues, and ill-conditioned ulcers in depraved constitutions, it constitutes the most valuable agent to which the invalid can resort.

"If the individual about to submit himself to the use of this water, is suffering from fulness and tension about the head, or pain with a sense of tightness in the chest or side, he should obtain relief from these symptoms before entering upon its use. If his tongue be white, or heavily coated; or if he be continuously or periodically feverish, or have that peculiar lassitude, with gastric distress, manifesting recent or acute biliary accumulations, he should avoid its use until, by proper medical treatment, his biliary organs are emulged, and his system prepared for its reception. Much suffering, on the one hand, would be avoided, and a far larger amount of good, on the other, would be achieved, if visitors were perfectly aware of, and carefully mindful of these facts.

"It is an every day occurrence during the watering season at the 'White,' for persons to seek medical advice, for the first time, after they have been using the water for days, perhaps, for weeks, and it is then sought because of vagrant operations, or injurious effects of the water. In most such cases, there will be found, upon examination, either the existence of some of the symptoms just mentioned, or evidences of *local inflammation* in some part of the body, sufficient to prevent the constitutional efficacy of the remedy. We are often struck with the control which an apparently inconsiderable local inflammation will exert in preventing the constitutional effects both of mercurials and mineral waters. To remove such local determinations where they exist, or greatly to lessen their activity, is all important to secure the constitutional effects of sulphur water."

Dr. M. farther enumerates, as coming under the benign influence of the White Sulphur water, dyspepsia, including gastralgia and pyrosis, chronic diseases of the liver and spleen, jaundice, chronic irritation of the bowels, diseases of the urinary organs, and diabetes. He thinks less of its value in amenorrhœa, dysmenorrhœa, and atonic leucorrhœa. When resorted to in these cases, the use of warm sulphur baths ought to be conjoined. In chronic affections of the brain, bordering on mania, and most remarkably in chronic cutaneous affections, also, in rheumatism and gout in their chronic states, and in scrofula, dropsies, and mercurial diseases, the water has been found to possess great virtues.

CHAPTER XII.

Red Sulphur—Salt Sulphur—Sweet Sulphur—Blue Sulphur—Sweet Springs—Red Sweet Springs—Healing Springs — Dibrell's — Rawley's — Holstein — Church-Hill Alum—Huguenot.

Red Sulphur Spring—in Monroe County, 42 miles from the White Sulphur, 39 from the Sweet Springs, 32 miles from the Blue Sulphur, and 17 from the Salt Sulphur. This spring furnishes a water which is the mildest of the group, and perhaps of its class; and it has even been regarded by some as sedative in its operation on the animal economy, although this is a contested point. If it act as a sedative, it does so probably in an indirect or secondary manner, as explained in a previous chapter. But still more, it has been extolled for its power to cure pulmonary consumption itself. Instances are recorded of its effects on the action of the heart, so as to reduce the beats of this organ from upwards of 100, and even 120 and 130, to 70 and 65 in a minute. Drinking of it allays thirst and causes sleep. That it has really a soothing and salutary effect in tracheal and bronchial irritation seems to be pretty evident; but of its curing consumption we have, I believe, no well authenticated proof. It will not probably aggravate this disease, as the water of the White Sulphur does. For details of the operation and curative powers of the Red Sulphur, the reader is referred to the work of Dr. Burke on "The Mineral Springs of Virginia." This writer gives a tolerably comprehensive list of diseases in which the red sulphur water has been found available, viz: chronic laryngitis, chronic bronchitis, hemoptysis, *chronic* phthisis, functional disease of the liver, hypertrophy of the heart, mucous diarrhœa, irritability of the nerves with sleeplessness, irritation of the kidneys and bladder, lithic acid gravel, chronic hepatitis, amenorrhœa, dysmenorrhœa, menorrhagia, chronic splenitis, chronic gastritis, hemorrhoids, scrofula and chronic exanthemata. It is contraindicated in plethora, tendency to apoplexy, and in epilepsy, vertigo, and the acute stages of disease.

In a former work, published twenty-five years ago, I pointed out the then alleged efficacy of this water in hemoptysis, and in reducing vascular excitement.

Drinking from nine to twelve and sixteen tumblerfuls of the water, on successive days, caused at first a diuretic and a diaphoretic, and, when continued to the fifth day, produced bilious evacuation "as much," writes one writer (Dr. Scott, of Lexington, Va.), "as I ever experienced from an active *portion of calomel*." Dr. Hayes and Dr. Wm. B. Rogers attribute much of the good effects of the water to an organic matter found in it and many other springs. Dr. Hayes calls it a sulphur compound.

On analysis, Dr. Hayes found 50,000 grains of this water (nearly seven pints) to contain of solid matters—

	Grains.
Silicious and earthy matter	6.70
Sulphate of soda	3.55
Sulphate of lime	0.47
Carbonate of lime	4.50
Carbonate of magnesia	4.13
Sulphur compound	7.20
Carbonic acid	2.71
	23.26

The same quantity of water exhibited, of dissolved gases, the following:—

Carbonic acid	1.245
Nitrogen	1.497
Oxygen	.260
Hydrosulphuric acid	86
	3.088

The gaseous contents of a gallon, or 231 cubic inches, of the Red Sulphur water were as follows:—

Carbonic acid	5.750
Nitrogen	6.916
Oxygen	1.201
Sulphuretted hydrogen	0.397
	14.264

There is no free carbonic acid.

We may doubt the propriety of introducing in the record of an analysis, as has been done above, a sulphur compound, the constituent parts of which are not known. M. Fontan, in his valuable work on the mineral waters of the Pyrenees,* shows that the baregine or glairine—the organic matter or sulphur compound found in sulphureous waters—consists of two distinct parts: 1st. *Baregine*, properly so called, an azotized and gelatiniform substance; and 2d. *Sulphuraria*, a vegetable confervoid in close affinity with the genus *anabaina* in the oscillariæ tribe. When the sulphuraria is exposed to direct light, and its white pearly color changed in consequence, there are developed in the filamentous masses which it forms, some other confervoid plant, whose characters are not yet fully ascertained.

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* Recherches sur les Eaux Minerales des Pyreneés, &c., 1855.

As regards the part which the baregine may be supposed to perform therapeutically, we learn that although, in the Pyrenean springs, it is always in proportion to the amount of the sulphureous principles, it constitutes, in fact, no part of them. They consist mainly and chiefly of sulphur combined with sodium in the form of a sulphuret; and secondarily, in much less degree, of sulphuretted hydrogen. Sulphur deposited with the filamentous structure, is merely so much abstracted from the water, which certainly is not more active in consequence. M. Fontan proposes to give the name of *pyrenine* to the substance heretofore called baregine or glairine.

Salt Sulphur Springs.—The designation of salt is hardly justified by the very minute quantity of chloride of sodium which enters into the composition of these waters. It contains larger proportions of sulphates of soda and magnesia. The temperature varies from 49° to 56° F. As more aperient and diuretic than some others of its class, the Salt Sulphur, though it must still be ranked as an excitant, is applicable to mixed cases of febricula and languor, as in chronic dyspepsia and renal affections, and chronic diarrhœa; in some of which the frequency of the pulse has been diminished under its use. The water of the "New Spring," with a smaller proportion of saline matters has more evident traces of iodine than the "Old Spring."

Analyses of the waters of the Salt Sulphur Springs have been made by Dr. Rogers, of Va., and Dr. David Stewart, of Baltimore. In both, the sulphate of lime figures largely; but the chloride of sodium in very small proportion—a grain and a half in the gallon of water, according to Dr. S. While there is an agreement between the two chemists in regard to the gases in this water, the proportions which they give are very different. Thus, while Dr. Rogers finds only 3.46 cubic inches of sulphuretted hydrogen, Dr. Stewart reports 19.19 of this gas, in a gallon of the water. The latter gentleman specifies in this quantity of water 20 grains of sulphate of magnesia, 24 grains of sulphate of soda, and 33 grains of carbonate of lime.

Of the other springs, the Iodine or New Spring is the more active. Its water contains iodine, bromine, carbonates of potash and of soda, alumen and phosphate of soda, compounds not found in the other spring or Salt Sulphur proper.

Dr. Moorman,* after referring to some precautionary advice of Dr. Mutter, who has written an instructive pamphlet on the subject of these waters, repeats the opinions of the latter gentleman in the following terms:—

"But in chronic affections of the brain, in neuralgia and nervous diseases generally; in some affections of the chest, particularly such as are brought on from the retrocession of some habitual discharge; in chronic affections of the kidneys and bladder; in rheumatism and gout, and in many diseases of the skin, it is among the most valuable of our remedial agents. The same may be said of its value in *mercurial sequelæ*—in hemorrhoidal affections, and in some of the chronic diseases of the womb.

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* Op. cit.

"In the various and multiform diseases affecting the abdominal viscera—such as hepatitis, jaundice, gastritis, pyrosis, dyspepsia, and some forms of diarrhœa, the Salt Sulphur is one of the most valuable of our remedial agents.

"The result of our own observations for many years, leads us to entertain a very high opinion of the salt sulphur water in dyspepsia—and particularly in cases connected with obstinate costiveness."

The Blue Sulphur Springs (Greenbrier County) are thirty-two miles from the Red Sulphur, and nearly the same distance from the Salt Sulphur Springs, and twenty-two miles from the Sweet. Resembling in their chemical properties those of the White Sulphur, these waters are applicable to the same diseases, and require the same precautions for their use as the former.

Temperature variable from 46° to 56°. Analysis by Dr. Roger's: Solid matter procured by evaporation from 100 cubic inches, weighed, after being at 212°, 44.62 grains.

Quantity of each solid ingredient in 100 cubic inches estimated as perfectly free from water:—

	Grains.
Sulphate of lime	20.152
Sulphate of magnesia	2.760
Sulphate of soda	9.021
Carbonate of lime	2.185
Carbonate of magnesia	0.481
Chloride of magnesium	0.407
Chloride of sodium	1.868
Chloride of calcium	0 005
Peroxide of iron derived from proto-sulphate	0.015
An azotized organic matter blended with sulphur, about	3.000
Earthy phosphates	a trace.

Volume of each of the gases in a free state contained in 100 cubic inches:—

	Cubic Inches.
Sulphuretted hydrogen	0.45 to 0.60
Nitrogen	3.25
Oxygen	0.50
Carbonic acid	2.75

The stimulant operation attributed to the water of the Blue Sulphur, is denied by Dr. Hunter, the experienced resident physician; but his experiments on different individuals, as reported by him, leave the question unsettled. We may, however, very well demur to the practice of giving it in inflammatory fevers, as impliedly recommended by Dr. Hunter. Putting aside speculative considerations, we can place more confidence in this gentleman's conclusions, the result of experience, respecting the remedial value of the Blue Sulphur water. He enumerates the diseases to which its use is applicable, viz: Nervous disorders, including hypochondriasis, hysteria, catalepsy, chorea, chronic hepatitis, amenorrhœa, irregular menstruation, and dysmenorrhœa, chronic diseases of the urinary organs, chronic diseases of the skin, particularly the class of scaly diseases.

A well conducted Bathing establishment under the direction of Dr. Martin, gives additional attractions to the Blue Sulphur Springs.

The Sweet Springs, among the first of the mineral springs of this region which were visited by invalids, still retain their early attractions. They are situated on the eastern border of Monroe County, seventeen miles from the White Sulphur and twenty-two from the Salt Sulphur, in a beautiful valley, bounded on the north by the Alleghany, and on the south by the Sweet Springs Mountain. It is the spot where the last rally of visitors is made for the season, before separating for their several homes.

The temperature of the water, 74° F., places it in the thermal class. Being in taste sub-acid and slightly alkaline, and evolving freely carbonic acid, it belongs to the class of acidulous waters, and may be used with the same benefit as these are. It is applicable, therefore, to irritable dyspepsia, with gastralgia, renal and hepatic colic, and to bilious diarrhœa. In renal affections, and especially in those of the lithic and phosphatic diathesis, and in irritable bladder, it is calculated to do much good, when continued for an adequate period. The same remark applies to chronic gout, of which these disorders are often varieties.

The full therapuetical value of the water of the Sweet Springs is far from being properly appreciated; and if a careful clinical record of each disease, regularly subjected to its use, were to be kept for a few seasons by a resident physician, it would show that these springs might be compared advantageously with some of the most noted of the class on the continent of Europe. Their tendency, after a time, to produce constipation, and their immediate effects, evinced in fulness of the head and often drowsiness, point to their cautious use, if not their being withheld, for a while, at least, in general and also in local plethora.

The copious and continued supply of the water, which is received in a large reservoir for bathing, and its temperature, are such as to attract many to the spot on this account alone, who could not take a cold bath, but who find in this temperate one a means of refreshment and invigoration, some would say rejuvenation, in which old Jason himself might have rejoiced, notwithstanding the marked preference of his daughter and doctress Medea for the hot bath.

Red Sweet Springs.—These are only a

mile distant from the Sweet Springs, which they closely resemble in all essential particulars; with the exception of their being more evidently impregnated with iron than the latter. The two prominent gases are nitrogen and carbonic acid, in the proportion, respectively, of 62.5 and 37.5 cubic inches per cent. of the entire volume. Of the three springs, the upper has a temperature of 77° F., the middle 80°, and the lower 79°, the waters of which, blended into one stream, give a temperature of about 78° F., or 4° higher than the Sweet Spring. The bathing house is a large building, suitably divided for the two sexes.

Dibrell's Spring, on the road from the Natural Bridge to the White Sulphur Springs, belongs to the sulphureous class.

Healing Springs.—These springs, of recent discovery, are situated south of the Hot Springs, at the short distance of three and a half miles. "They are placed," as we learn from Dr. Burke, "in the gorge of the mountains near the road to the celebrated Falling Spring, one of the curiosities of this region." In their composition, they are represented by the same writer to be "apparently very like the Sweet Springs, or, perhaps, more so to the Red Sweet, since the chalybeate flavor is more distinct than that of the former. Like the springs mentioned, they bubble up from the ground."

They are said to perform wonders in rheumatisms, sprains, herpetic eruptions, and cutaneous diseases generally, and in scrofulous ulcers. Effects hardly short of the miraculous have been attributed to the waters of the Healing Spring.

The temperature, 84° F., two degrees above that of the famed Buxton, in England, makes a bath of its water adapted to a large circle of diseases in which there is still remaining excitement, a frequent pulse, dry skin and thirst, and in which its moderately contrastimulant operation is better borne, and more useful than if baths of a lower temperature were resorted to. As a means of healthful enjoyment, it must rank highly, especially for children, delicate females and the dyspeptic student.

Rawley's Spring, a strong and simple chalybeate, is in Rockingham Co., twelve miles from Harrisonburg, and one hundred and twenty northeast from the White Sulphur.

The Holstein Springs are in Scott Co., in the southwestern angle of the State, near the Tennessee line, forty miles from Abingdon, and sixty from the Warm Springs of Buncomb Co., N. C. One of them comes within the thermal limits, being 68°.5 F., or fifteen or sixteen degrees higher than the common springs of the country around. Of the saline constituents of the water, the chief ones are sulphates of magnesia and of lime; the saline contents altogether being 41.14 grains in the gallon. It is represented by Dr. Gaines, to whom I am indebted for all the information I have on the subject, to be actively diuretic, and with suitable appliances diaphoretic. Its action on the bowels is induced, by restoring to the digestive canal its lost tone and healthy secretions. With proper caution, the bath will be found serviceable in certain cases.

In Eastern Virginia, I have to speak of two springs which merit attention.

Church Hill Alum Spring.—This is a recent addition to the mineral springs of Virginia, having been discovered or rather opened only a few years ago, in the process of levelling a street, which bordered on the garden of a lady in the city of Richmond. The supply of water is abundant, and its mineral constituents place it at the head of this class of springs. An analysis by Professor Booth shows it to contain 184.5 grains of alkaline salts, 159.5 of salts of iron, and 7.3 of persulphate of alumina in a gallon. Of the alkaline salts nearly one-half is Epsom salts. On this account it is generally aperient, while, at the same time, owing to its large aluminous and chalybeate impregnation, it manifests actively tonic and astringent properties. This alum water is of great value in a number of diseases, such as passive hemorrhage, the profluvia, nervous diseases, and cutaneous and ulcerative affections. It is used to a considerable extent in Philadelphia. I have prescribed it in several cases with decided benefit.

Huguenot (formerly Howard's) *Springs.*— These are two in number, a *Sulphureous* and a *Chalybeate*, situated near James River, in

Powhattan Co., 17 miles above Richmond, on the main river road, between that city and Lynchburg. The Sulphur Spring resembles the White Sulphur; but its water is not so strong as that of the latter. The chalybeate has the virtues of its class. Dr. Royster, to whom I am indebted for a notice of these springs, writes favorably of their utility in different diseases. Suitable arrangements have been made for the reception and accommodation of visitors.

CHAPTER XIII.

KENTUCKY SPRINGS.

Kentucky Springs—Harrodsburg—Rochester—Olympian—Blue Lick—Lower Blue Lick—Ohio Springs—Yellow Spring—Westport—Illinois Springs—Tennessee Springs—White Creek—Robertson's—Lee's—Nashville—Winchester—Montevale.

FOR a knowledge of the chief mineral springs of Kentucky, I must gratefully acknowledge my obligation to Dr. Drake.*

Harrodsburg Springs.—"These springs belong to the basin† now under examination, being situated near the sources of Salt River. Unlike most of the mineral springs of Kentucky, which are found in deep valleys, these burst out near the summit-level of the country, at an altitude of near a thousand feet above the Gulf of Mexico. From near the springs, small tributaries of the Kentucky River and of Dick's River, flow off to the east and north, and those of Salt River to the south and west, a sufficient evidence of the relative elevation of the spot where they are found. In every direction, for several miles round, the country is as free from drowned lands, marshes, swales, and ponds, as any other equal area in the Ohio Basin. In fact, there does not seem to be a single source of malaria in their neighborhood, and my colleague, Professor Miller, who practised medicine nine years in this locality, has assured me that intermittent and remittent fevers are far less prevalent here than in the Barrens.

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* Principal Diseases of the Interior Valley of North America, Vol. I.

† [Basin of Salt River. Up this stream the defeated party, after a political contest in our country, is invited to take refuge. I have myself received, before now, a printed card, in the form of a free ticket, for this destination.—J. B.]

"The town of Harrodsburg, in the suburbs of which we find the springs, was the first-settled spot in the state of Kentucky, and, consequently, the soil has been under cultivation since the month of June, 1774; that is, nearly seventy-five years, a period quite sufficient to diminish those elements on which autumnal fever remotely depends. I am the more careful to set forth these facts, because most of the watering places in the west, from being in valleys, are scourged in August and September with bilious fevers, and because the invalids of the southwest, especially those who have been made such by its fevers, cannot have their constitutions repaired by sojourning at springs which are situated in malarious localities.

"Harrodsburg Springs are not only in the oldest-settled spot in the valley of the Ohio, after Pittsburg, but they issue from strata which, I am informed by Professor Yandell, rest upon the very oldest formations known in the Ohio Basin. Considered in reference to chemical character, they are magnesian limestone.

"Desirous of publishing an accurate account of the composition of these waters, I desired Dr. C. H. Raymond, of Cincinnati, to visit and analyze them, which he did in the month of October, 1848, selecting the two fountains from which invalids are chiefly supplied. The following are the results with which he has furnished me:—

THE GREENVILLE SPRING.

Ingredients in a pint of the water, stated in grains and hundredths, Troy.

Bicarbonate of magnesia	2.87
Bicarbonate of lime	0.86
Sulphate of magnesia (crystallized)	16.16
Sulphate of lime (crystallized)	11.06
Chloride of sodium trace.	
	30.95

THE SALOON, OR CHALYBEATE SPRING.

Quantity of water the same.

Bicarbonate of magnesia	0.43
Bicarbonate of lime	4.31
Bicarbonate of iron	0.50
Sulphate of magnesia (crystallized)	27.92
Sulphate of lime (crystallized)	10.24
Chloride of sodium	1.24
	44.60

"The bicarbonate of iron in this spring is sufficient to impart to its salts a light fawn color. The water of both springs is limpid. Dr. Raymond could not detect either free carbonic acid or sulphuretted hydrogen gas.

"It will be seen by these analyses, that every tumbler of the water of the Greenville Spring contains within a fraction of sixteen grains of saline matter, more than half of which consists of magnesian salts; that every tumbler of the water of the Saloon Spring contains twenty-two grains of saline matter, two-thirds of which are sulphate, with a small quantity of bicarbonate, of magnesia; and that in the same quantity of the water there is a quarter of a grain of iron. The patient who, in one morning, drinks four tumblers of the water of the Saloon Spring, takes nearly a drachm of sulphate of magnesia, with other saline ingredients, and a grain of bicarbonate of iron.

"I shall follow these estimates no further, but proceed to say, that the water of the Greenville Spring is the better antacid—that of Saloon, the better tonic. Indeed, small as the quantity of iron is, it sometimes produces an uncomfortable feeling in the head, which is relieved by drinking at the other fountain. In reference to the excretions, the water from both acts upon the bowels, kidneys, and under proper regulations at night, upon the skin. Beyond these sensible effects, it pervades the whole constitution, and many classes of invalids very soon feel a renovation of appetite, strength, and cheerfulness, although its primary effects seem to be sedative, not stimulant. I transcribe from the article in the journal already quoted (*Western Journ.*, 1828), the following remarks on the curative effects of these waters.

" 'The cases to which they are, in a peculiar manner adapted, are chronic inflammations and obstructions of the abdominal viscera. Thus, they are eminently serviceable in such cases of dyspepsia as are attended with subacute gastritis, in almost every kind of hepatic disorder, except when the liver is indurated, and, consequently, incurable; and in constipation, so constant an attendant on diseases of the stomach and liver. They are almost equally beneficial in chronic inflammations of many other parts of the system—especially of the serous and fibrous membranes. In tonic dropsies, in rheumatism, and in various affections of the periosteum from febrile metastases, from syphilis, and from mercury, they have often effected a cure, when other means had failed. In several urinary disorders they have done equal good. In chronic diseases of the skin they have also been found useful, when the patient has been subjected to a regimen that has determined them to the surface. In pulmonary complaints they have been found serviceable, but not in the same degree as in disorders of the abdominal organs, and their use in those maladies requires discrimination. In chronic pleurisy, and the early stages of subacute bronchitis, they have performed cures; but in vomica, tubercular suppurations, and hepatization of the pulmonary tissue, they are injurious, and, if persevered in, may even prove fatal. When they have rendered occasional assistance in these affections, it was chiefly by correcting a morbid condition of the digestive functions, so often associated with them. In sick headache they occasionally do good, but many cases of that obstinate malady are attended with such an enervated condition of the nervous system, that their sedative operation becomes prejudicial.'

"The experience of multitudes, since these remarks were published, twenty years ago, has, in the main, confirmed their accuracy, and even added to the catalogue of maladies which have been palliated or removed.

"The Harrodsburg waters have, by exportation, been extensively distributed over the southwest, and even found their way into use in several of our garrisons. The salts obtained by their evaporation have long been employed by the people, and also by many physicians, who have found them more efficacious than the officinal sulphate of magnesia.

"It is proper to say something of what art has done to make this an acceptable residence to the infirm, and to the friends who may desire to accompany them. To this end the enterprising and courteous proprietor, Dr. Christopher Graham, through a period of twenty-five years, has devoted himself, with a liberality only equalled by his taste and diligence. Within that period, his permanent expenditures have exceeded two hundred thousand dollars, and he is still inventing new means for comfort, amusement, and the beneficial use of the water; among which are baths, both cold and warm, the latter of which, from the high degree of saline impregnation, cannot but prove valuable in a great variety of cases.

"A topographical map of the grounds around the principal spring, including the various improvements, has been made at my request, by Captain Fuller, topographical engineer, the inspection of which will render a description of them unnecessary;* and I need only say, that while the waters are perhaps adapted to as great a variety of infirmities as any now in use in any country, the accommodations which have been created will, from the reports of travellers, bear an advantageous comparison with any to be found either in America or Europe. Such is the spot which, in the midst of a highly cultivated society, may be added to the wild scenes on the Tennessee River, the Mammoth Cave, the Upper Mississippi, and the Great Prairies, already recommended as places of beneficial resort for various classes of invalids.

"But the attractions of the Harrodsburg locality are not confined to its medicinal waters and its munificent accommodations;

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* The map is given in the volume from which the present account of the springs is taken.

for, although it lies in a region of fertile and gently-rolling country, which would seem to promise nothing rare or romantic in nature, it is by no means destitute of objects and scenery which the eye of taste must regard with the deepest interest. About fifteen miles to the southeast are the "Knobs," where, on a plain, the basis of which is the black or Devonian slate, may be seen a scattered and picturesque group of slate-clay pyramids, or rude, truncated cones, rising from one to two hundred feet in height. At a less distance to the east, is the gorge through which Dick's River precipitates itself into the Kentucky. Lastly, at the distance of eight or ten miles to the north, the beholder finds himself on the verge of a chasm, as deep, and dark, and wild, as that of Niagara below the Falls. In this profound ravine, with walls of the oldest transition marble, and a garniture of mingled evergreen and deciduous forest trees, the Kentucky River quietly winds its way, and, by its very repose, seems to say that its work of excavation is finished."

There are, writes Dr. Drake, in the

Western Journal, for 1828, other Epsom springs in Kentucky, besides those of Harrodsburg; of which the only one that has acquired notoriety, is situated ten or twelve miles from that town, and one from Perryville. It is named the

"*Rochester Spring.*—It is a feeble but constant stream, that bursts out about sixty feet below the summit of a ridge of coarse grained, shell limestone. From the experiments and observations which I have made upon this water, its sensible qualities, composition and effects are so nearly the same with those of the waters just described, that a detailed account of them would be superfluous."

The Olympian Springs [or *Mud Lick*], continues this writer, in the same journal as above, constitute one of the oldest and most noted watering places of Kentucky. They are situated in Bath County, about fifty miles east of Lexington, on the waters of Licking River, which unites with the Ohio, opposite Cincinnati.

On approaching them from the west, the country undergoes a change in its topography, geology, and botany. The gentle slopes that give such beauty to the basin of Elkhorn, and the "country round about," of which Lexington is the metropolis, are succeeded by high and steep hills, the summits of which are narrow and serpentine. This is the commencement of the broken country, which, becoming more and more Alpine as we advance to the east, at last terminates in the Alleghany Mountains. With this change of aspect, there is a corresponding change of structure. The first shows itself, on approaching Slate Creek, between Mountsterling and the springs, where we observe strata and beds of arenaceous limestone, alternating with the blue, shell limestone just passed over, and presenting organic remains of a different kind.

Two miles from the springs is a detached and somewhat conical summit, that has received the name of Olympus. It may be regarded as a specimen of the region adjoining, and still further east. The road to Beaver Creek Iron Works passes near the base of Olympus, and at length the observer, ascending from the valley, finds himself at an elevation of six or eight hundred feet, and sees around him nothing but deep and angular valleys, mural precipices, and rocky summits, which resemble ruined fortresses and towers.

There are several springs and wells, which present such differences in their composition, that of all the watering places of the west, this is supposed to afford the greatest variety. Dr. Drake says, further:—

"I could not myself detect more than three kinds—a *salt* and *sulphur*, a *white sulphur*, and a *chalybeate*.

"1. The Salt and Sulphur water is pumped up from a shallow well, near the margin of the brook. The temperature of the water as its issues from the pump is 58° of F. Its taste is that of a weak brine, moderately charged with sulphuretted hydrogen. Compared with the greater number of salines in the western country, the quantity of common salt which it contains is small, and the sulphuretted hydrogen is too little to escape from the surface in bubbles. When the neighboring stream is swollen, its waters find their way into the well, which then affords a more dilute solution. It was in this state when my observations were made.

"Subjected to the action of a variety of reagents, it afforded the following results; which, however, I do not state with confidence in their accuracy.

"1. Sulphuretted hydrogen.

"2. Muriate of soda, or common salt, and perhaps a little muriate of lime.

"3. Carbonate of soda.

"I could detect no sulphuric acid, and, consequently, it contains no Epsom salts; and if either lime or magnesia be present, the quantity is exceedingly small.

"2. The White Sulphur Spring is situated half a mile from the well. It bursts out from a bank of shale, a short way up the side of a hill. Mr. Bankes, of Mountsterling, assured me that this spring made its first appearance during the earthquakes of 1811. Its temperature is 59°. Its composition is substantially the same with that of the well just described, but the ingredients of the two springs vary in their proportions. In the Sulphur Spring, the quantity of that substance is so great as to be deposited in the form of a whitish sediment, upon the leaves and twigs which the water flows over. Silver is more speedily tarnished than in the well, and the proportion of sulphuretted hydrogen is sufficient to rise in bubbles to the surface, but still is much less than in many other springs in Kentucky. On the other hand, the spring has but a weak impregnation of muriate of soda, compared with the well. The proportion of carbonate of soda seemed to be nearly the same in both. I could not detect in it either sulphuric acid or magnesia. The existence of iodine in sulphuretted waters, not having at the time of my visit been made known, I did not, of course, examine for them.

"3. The Chalybeate Springs. These are two in number, and are situated about forty yards apart, and half a mile from the salt and sulphur well. They burst out from between strata of arenaceous limestone, near the bank of a stream, which a mile below mingles its waters with those of the brook already described. Their temperature, as the water issues from the rock in lively currents, is 52° F. They deposit a reddish sediment. From a variety of experiments on the water of the lower of these springs, I was satisfied that it contains nothing but the carbonate of iron, with the proportion of muriates and carbonates, which our common springs afford. I observed the bottles in which it was carried to the lodges of invalids, to be incrusted with the red oxide of iron, from the decomposition of the carbonate of that metal, and the escape of the carbonic acid, by the agitation. Thus many who thought themselves in the use of an efficient chalybeate, were drinking a water which contained little else than what exists in ordinary springs.

"Besides the fountains, which I have described, there is another—a feeble vein—near the principal well, and called the *Vitriol Spring*. It seemed to contain muriates and carbonates only, and these in such moderate quantities, that it is used for culinary purposes, although spoken of as medicinal. I could not discover in it either sulphur, magnesia, or sulphuric acid.

"The following are the principal observations which I made on the spot.

"The salt and sulphur water was chiefly drunk. From one to eight tumblerfuls were taken in the morning. It lay light on the stomach. Its diuretic effect was prompt and certain. Its action on the bowels was, in most cases, so inconsiderable, that common salt was added to increase its aperient qualities; and many persons found it necessary, besides, to dissolve in it a portion of Epsom salt. To some dyspeptic stomachs it was oppressive, even in small quantities, and in one delicate female I saw it produce a tendency to syncope. In many persons it produced abdominal distension, and a few thought it the cause of more obstinate constipation, which arose, perhaps, from its great determination to the kidneys.

"During my week's residence at the springs, I saw no invalids in a rapid state of recovery, nor heard any speak with applause of the beneficial effects of the water upon them. It is certain, however, that many interesting cures have been effected by it, although it is less powerful than some other springs of the same kind."

Dr. Peter enumerates six different springs of the Olympian group, of which three contain sulphuretted hydrogen, two are saline chalybeates, and one is acidulous. If we except one of the second class, called the Epsom Spring, their saline constituents, although diversified in number, are, in amount, inconsiderable. Of the other five, the White Sulphur or Tea Spring water has the weakest, and the Black Sulphur the strongest, saline impregnation.

The completion of the railroad from Lexington to Big Sandy River will contribute to make these springs, once more, a place of general and fashionable resort; additionally attractive as it is, by "the novel objects and romantic scenery which it presents."

Blue Licks.—At this watering place, Dr. Drake tells us, there are several fountains, all, however, of one kind, the sulphureous saline. They are found on either bank of Licking River, twenty-four miles from the Ohio, and at the intersection of the former by the high road that leads from Maysville to Lexington. From the first settlement of the State, till within the last fifteen years, salt was manufactured at this place. The manufacture was rendered unprofitable by the increasing scarcity of fuel, and by the discovery of stronger water in Western Virginia and Pennsylvania.

Lower Blue Lick Spring.—In all that relates to the geology of the region in which this spring is found, and to the analysis of its water, I avail myself of the information kindly furnished by Professor Peter of the Kentucky School of Medicine.

The geological formation in which the Blue Lick Springs are located, is the same as that which underlies Cincinnati and the central fertile region of Kentucky, called by the western geologists the great Blue Limestone formation. It is a lower member of the so-called Silurian System of Murchison. It is a formation of great thickness in the west, composed of limestone layers of greater or less thickness, hardness and purity, with beds of bluish marly clay presenting sometimes a shaly structure; all rich in the fossilized remains of inhabitants of the deep primeval ocean under which they were evidently deposited.

"The well known Big Bone Lick of Kentucky is seated on this same rock formation, and the composition of the water of the spring in that locality appears, by all accounts, to be nearly analogous to that of the Blue Licks; it being a saline sulphur spring like the latter. Indeed, the Blue Limestone is very generally known as a saliferous formation; which is doubtless to be referred to its submarine origin. Numerous springs of salt water have been found on it, and many salt wells, some containing sulphuretted hydrogen, have been obtained in it by boring.

"At the Blue Licks, beside the main spring, there are a number of minor ones, on the two sides of the Licking River and in its bed, the water of some of which has been examined by the author, and found to be very much like that of the principal spring in composition. Johnson's Well, in Scott County, Ky., also presents a composition somewhat analogous to that of the Blue Lick water, but it is much weaker, and it contains more magnesian salts.

"While the water of the superficial wells and springs, on this formation, are generally what is denominated *hard* or *limestone water*, containing bicarbonates of lime and magnesia, with a little iron, and some phosphate of lime, held in solution by carbonic acid; these salt wells, or "licks," so called, contain chlorides of sodium and potassium, chlorides of calcium and magnesium, sulphate and carbonate of lime, &c., and are frequently impregnated, to a greater or less degree, with sulphuretted hydrogen. Saline water of this character, as above intimated, has been frequently obtained in the Blue Limestone formation by boring. For example, in the little town of Keene, in Jessamine County, Ky., a water was obtained in this manner, in 1848, by Mr. Wm. R. Dean, which is a very good salt sulphur water, and has been considerably employed for its medicinal properties. It contains sulphuretted hydrogen and carbonic acid gases; bicarbonates of lime and magnesia, with a trace of bicarbonate of soda; chlorides of sodium, calcium, magnesium, and doubtless of potassium, with a trace of iron; but this is much weaker than the Blue Lick water containing only 16 grains of saline in the 1000 grains of the water; being only about one-sixth the strength of the former. In a later testing, in May, 1850, it was found to be yet weaker, probably because of the then extremely wet season. This water has not been fully analyzed to detect the presence of iodine and bromine.

"In Scott County, of this State, in a well bored to the depth of 176 feet in this limestone, Mr. W. Roszell obtained a water which contains a notable proportion of chlorides of sodium, calcium and magnesium, &c. &c., and smells strongly of sulphuretted hydrogen. The water of another bored well, 105 feet deep, obtained in 1848 by Major B. Roberts, in Harrison County, also on the Blue Limestone formation, has a very slight bituminous or sulphureous odor, but contains as much as sixteen parts in the thousand of saline matters, principally chloride of sodium, with chlorides of potassium, calcium and magnesium; sulphate of lime; bicarbonates of lime, magnesia and iron, and a trace of iodine. This is rather stronger in salts than the Blue Lick water, and differs from it also in its deficiency of sulphuretted hydrogen, but in other respects they resemble each other very much in composition.

"Another well, 81 1-2 feet deep, was made by boring, in Scott County, near Georgetown, on the property of Mr. R. Ford, the water of which contains as much as 4 per cent. of saline matter, principally common salt, with sulphates of lime and potash, chlorides of calcium and magnesium, &c. &c. Some of the wells in Lexington yield a water smelling slightly of sulphuretted hydrogen, and while penning these remarks, a bottle of water was brought to me from a boring in progress, forty-five feet deep, in this city, which is a weak sulphur water.*

"Saline and saline-sulphur waters, therefore, are quite frequent, comparatively, in our Blue Limestone strata, but amongst all the springs of this nature, known at present on this formation, in Kentucky, none are as valuable, and as remarkable, in many respects, as those of the Lower Blue Licks.

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* Associated with the water thus obtained by boring, in our Blue Limestone, is sometimes found a large quantity of light carburetted hydrogen gas. One remarkable instance occurred in Franklin County, at the mills of the Messrs. Steadman, where, as I am informed, this gas, in large quantities is poured out from the boring, the stream lasting for some time, and perhaps existing at the present moment. The origin of this gas in the coal formations, where it is more abundant, is, doubtless, from the vegetable matters which formed the coal, but in this formation it is a puzzle to geologists. [Quite an active saline chalybeate water, containing some bromide of magnesium, and evolving free carbonic acid, has been found, by boring, in the cellar of Mr. John S. Wilson, druggist, Lexington.]

"The principal spring of this locality, from which the water submitted to analysis was taken, is situated near the banks of the Licking River, flowing out about twenty feet above low water in that stream. It rises in a hexagonal basin of stone, which has been built for it, which is six feet two inches in diameter, from one side to the opposite parallel one, and about five or six feet in depth. The quantity of water which flows out varies in different seasons. When the water for the present examination was obtained, June 6, 1850, it was low in the spring, and not running. The water in this basin was lowered about one foot by pumping out seventy-six barrels* in the course of three hours; and in the winter time the stream which flows out from it would probably fill a pipe three inches in diameter."

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* These barrels will not contain [each] more than thirty gallons.

"In six observations, at different times, on June 4th and 5th, the external air varying from 60° to 76° F., the temperature of the water stood very constantly at 62°. This is about seven degrees above the mean temperature of this region, which is about 55°; and it is probable that the temperature of the water in the basin had been somewhat raised by the external heat of the atmosphere. When flowing rapidly, it may, perhaps, be found to approximate more nearly to the mean annual temperature.

"The mass of water in the spring presents a light yellowish-green color, partly owing, perhaps, to the reflection from the yellowish-gray sediment, for when it is taken up in a clear vessel, it appears perfectly colorless, and beautifully transparent. On standing exposed to the air, however, it becomes of a yellowish-green color, very perceptible in a white pitcher, or even in a white glass bottle. This color deepens on boiling the water, but boiling does not cause it to appear in the recent water. This color, to which the spring probably owes its name of *Blue* Licks, is due to the decomposition of some of the dissolved ingredients. On exposure to the air, the hydrogen of the sulphuretted hydrogen, becomes converted into water by combining with oxygen from the atmosphere, while the sulphur, with the trace of iron, &c., is deposited as a light yellowish green precipitate, at the same time, in consequence of the escape of some of the free carbonic acid, carbonate of lime is thrown down, which mixes with the sulphur precipitate. The minute portion of iron which exists in the recent water, probably as carbonate of the protoxide, losing its carbonic acid and oxygen, becomes a sulphuret, by taking some of the sulphur of the decomposed sulphuretted hydrogen, and gives the greenish tinge to the water and its sediment.

"In the water which has been bottled, or brought in barrels from the spring, this change of color and consequent deposition occurs a few hours after it has been brought in contact with the air, by uncorking and withdrawing a portion out of the vessel. It changes, in a marked manner, in flavor, owing to the decomposition of the sulphuretted hydrogen; and after a few days' exposure, loses all smell and taste of this gas, as might be expected from its decomposible nature. To preserve its virtues in exportation, therefore, it should be bottled like a sparkling wine, and used as soon as it is opened. In this manner, if but little air be left in the neck of the bottle, and the cork is very tight and secured by sealing wax, it may be preserved, unchanged, for a considerable time. In the spring and its channel this decomposition and escape of gas continually take place, causing the formation of sediment. Less decomposition would probably take place in the spring, were its basin smaller, so that the water would be more rapidly renewed, and it would expose less surface to the air.

"Some of the *sediment* collected from the bottom of the spring, was found by analysis to contain the following ingredients, viz:—

Sand, in considerable proportion.
Carbonates of lime and magnesia.
Sulphur.
Oxide and sulphuret of iron.

Alumina.

A trace of oxide of manganese.

Apocrenic acid.

A trace of crenic acid.

"All these ingredients, except the sand, which is probably brought out mechanically suspended, were, doubtless, dissolved in the recent water, and were deposited on its exposure to the air.

"In addition to the gases, sulphuretted hydrogen and carbonic acid, which are thus gradually decomposed in the water, or which escape insensibly from its surface, streams of bubbles of gas are continually rising through the spring, and breaking into the atmosphere.

"Some of this *gas*, carefully collected for me by Major Owen, in bottles prepared for the purpose, was submitted to analyses, and found to consist mainly of nitrogen, mixed with about 4.5 per cent. of carbonic acid gas, and only a trace of sulphuretted hydrogen."

The composition of the Blue Lick water, according to this analysis, is as follows; calculated both in 1000 grains of the water and in the wine pint of 7,680 grains, viz:—

Gases in 1000 grains:—

Specific gravity . . . . . 1.007.

			In the wine pint.	
	Grains.	Cubic In.	Grains.	Cubic In.
Sulphuretted hyd. gas	0.0394	0.1086	0.3031	0.8340
Free carb. acid gas	0.3547	.0776	2.7240	5.8368

The former is in the proportion of about 1.36th, the volume of the water, and the latter about 1.5th the volume.

Saline contents in 1000 grains :—

	Grains.	In the wine pint. Grains.
Carbonate of lime	0.3850000	2.9568000
Carbonate of magnesia	0.0022065	.0169459
Alumina, phosphate of lime, and ox. iron	0.0058330	0.0447974
Chloride of sodium	8.3472930	64.1072102
Chloride of potassium	0.0226690	0.1740979
Chloride of magnesium	0.5272000	4.0488960
Bromide of magnesium	0.0009394	0.0302546
Iodide of magnesium	0.0007340	0.0056371
Sulphate of lime	0.5533300	4.2495744
Sulphate of potash	0.1519190	1.1166738
Silicic acid	0.0079400	0.1377792
Loss	0.2819861	2.2158335
	10.3000000	79.1040000

The water also contains traces of oxide of manganese, and apocrenic and crenic acids.

The solid contents of the Blue Lick water are to those of the White Sulphur, as rather more than 9 to 2. In the former are 64 grains of chloride of sodium or common salt to the pint; in the latter but a small fraction. The first contains but 3½ grains of sulphate of lime, that inert salt, if not one of equivocal benefit; and the second about 10 grains of the same. The White Sulphur holds in solution, however, sulphates of magnesia and soda, both of which are wanting in the Blue Lick; while in its turn the latter has chloride of potassium and sulphate of potash and bromide of magnesium, which are not in the former. The quantity of sulphuretted hydrogen in the Blue Lick is double that in the White Sulphur, even if we assume Dr. Roger's more favorable analysis as the standard. Iodide of magnesium is found in both.

The medicinal virtues of the Blue Lick water are those of a saline sulphur, and analogous to, but more active than the Olympian Spring water. It acts freely as a diuretic; but only on occasions as a purgative. It may be used with advantage in nearly all the chronic diseases in which the sulphur waters already described have been prescribed, especially in chronic rheumatism and cutaneous diseases; and in atonic dyspepsia and obstructed and painful menstruation. The use of the water as a bath is properly conjoined with its internal use.

The Blue Lick water is brought on to Philadelphia, and used by many persons with decided benefit.

One drawback to visiting the Blue Lick Springs is thus mentioned by Dr. Drake, in the first volume of his great work (p. 256). "In former times, when salt was manufactured here by furnace heat, autumnal fever seems to have prevailed but little. Latterly, however, the sluggish water which winds round the spring generates intermittents, which, nevertheless, do not become prevalent until the latter part of the summer, when watering-places are not much frequented."

Estill Springs.—I am again indebted to the kindness of Dr. Peter for the following notice of these springs:—

"Of the waters of the 'Estill Spring' (Estill Co., Ky.), I have tested two varieties sent to me in bottles, viz:—

White Sulphur.

Specific gravity, 1.001. (Sept. 1849.)
Saline contents, 0.09 per cent.
Contains—
  Carbonic acid and sulphuretted hydrogen gases.
  Carbonates of soda, lime, magnesia, and trace of carbonate of iron.
  Sulphates of lime, magnesia, and soda.
  Chloride of sodium in small amount.
  Hydrosulphate of soda?

Red Sulphur.

Specific gravity, 1.0002.
Saline contents, 0.04 per cent.
Contains—
  Carbonic acid and sulphuretted hydrogen gases.
  Carbonates of soda, lime, magnesia, and trace of carbonates of iron.
  Sulphates of soda, lime, and magnesia.
  Chlorides of sodium, calcium, and magnesium.
  Hydrosulphate of soda?

"A *similarity* in composition appears in the qualitative testing, but the quantity and *proportion* of the ingredients differ considerably—a fact only to be fully demonstrated by a complete *quantitative* analysis.

"There are other waters at the Estill Springs, and they are quite popular; but I have never examined any but those named above."

In OHIO, Doctor Drake says the mineral springs are numerous, but he adds the qualifying remark, that they are not greatly diversified in their properties, nor copious in the supplies which they afford. The most common mineral waters of the State are, he tells us, chalybeate. Of these he describes but one, "as the only watering place of notoriety in Ohio." This is

The Yellow Spring.—It is situated in Greene County, sixty-four miles north of Cincinnati, and two miles west of the Little Miami River, on the Cincinnati and Sandusky Railroad. "It is a copious and constant fountain, that issues between strata of arenaceous limestone, and thus has geological characters perfectly identical with the chalybeate springs of the Olympian valley in Kentucky." The temperature of the water is 52° F., precisely that of the other springs in the neighborhood. The water is transparent, emits no bubbles, and has a slight chalybeate taste; but this does not prevent its being used for a variety of domestic purposes. In composition it resembles all the other springs of a limestone country, with the addition of carbonate of iron.

The water acts as a diuretic, but whether more than common water in the same quantity is questionable. As a laxative its action is very small, if it can be considered as having this effect at all with any uniformity. Dr. Drake, from whom I take the preceding details, says that its water is rather restorative than curative, and as such it is admirable for convalescents. It is, if not the most potent, at least the most pleasant of tonics, and hence it is adapted to exhausted states of the system, following prior diseases of violence, or associated with dyspepsia, and various nervous disorders.

To the above we may add, from the saline class,

The Westport Spring.—It rises in the bed of Deer Creek, a tributary of the Scioto River, from a vast bed of clay slate, which for many miles forms the bed of the creek, and a cliff along its banks twenty feet high.

The water flows abundantly, so as to yield probably a barrel in two minutes, and when confined in a wooden tube it rises to the height of eighteen feet, and then runs over at the top. It contains sulphate of magnesia, iron and carbonic acid, which last gives it a sparkling appearance as it rises from the earth. In its operation it is moderately cathartic, and as such would be adapted to a number of morbid states not yet specified in its records.

In ILLINOIS, some springs have been noticed by Professor C. U. Shephard, under the title of the

Upper Illinois Springs.—Two, which come to the surface near together and by the roadside, may be denominated saline. The temperature is apparently above that of the springs in the vicinity, and certainly superior to the mean temperature of the climate. They contain carbonic acid and nitrogen gases, supercarbonate of lime, bicarbonate of soda, chlorides of sodium, calcium and magnesium, and sulphates of lime, magnesia and soda.

Sulphureous Spring.—The spring which issues from the sandstone layers nearly in the bank of the Illinois, is a strong sulphureous water, and in addition to the above enumerated ingredients, contains free sulphuretted hydrogen, and hydrosulphuret of sodium.*

Springs in the bed of the Vermilion River, at Vermilionville, are sulphureous in their character, and at the same time equally rich in saline matter with the Illinois Springs. It is difficult to obtain a supply of water from them, as their points of issue are completely overflowed at high stages of the river.

Of the TENNESSEE Springs I have not much to say, having been unsuccessful in some attempts to procure information respecting them. I will begin by repeating what is found in my first work on the subject.†

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* This is the first announcement, as far as I am aware, of the presence of this sulphuret in any of the sulphur springs of the United States.

† On Baths and Mineral Waters. To save the trouble of inquiry for this book, I may as well say that it has been out of print for many years. Its place is intended to be supplied by the volume already published, "Baths and the Watery Regimen," and the present Manual, and, finally, by the larger work already referred to, but not yet finished, on Mineral and Thermal Springs in all parts of the world.

"Nature has been exceedingly bountiful to the western region in the abundance and excellence of its sulphur springs; especially of those in which sulphur and the muriates of soda and lime are held in solution. Throughout the longitudinal range of Tennessee, for example, from west to east, from Nashville to the Virginia line, the traveller must have been struck with the number of these springs which present themselves in regular succession on or near the high road.

"*White's Creek Spring*, twelve miles from Nashville, is much resorted to. My stay at it was too short to enable me to glean much information respecting the virtues of its waters from personal observation. I learned that it contained sulphate of magnesia, iron, and sulphur. The impregnation with this last was very strong, the taste even acrid. Experience has shown that this water, when drank, is best adapted to diseases of low action. In calculous affections and cutaneous disorders, it has the reputation of having wrought wonderful cures.

"*Robertson's Springs* are saline. They are twenty miles from Nashville.

"In East Tennessee especially, inducements, presented as well from this cause as from the purity of the air and agreeable variety of scenery, are held out to many families from Mississippi and that region of country, for change of climate and travel. Many avail themselves of the advantages thus offered, and realize more completely what they hoped for than if they had visited more celebrated watering places, and become the slaves to fashions and usages, often irksome by their strangeness, and injurious by their taxes on personal comfort and health.

"Twenty miles east of Knoxville are *Lee's Springs;* two sulphur and a chalybeate: the last is very strong. At *Rutledge* (Granger County), and at *Beane's Station*, are strong sulphur springs."

Dr. Troost, in his Sixth Report of the Geological Survey of the State of Tennessee, enumerates several mineral springs, all of them sulphureous; viz: *French Lick*, *Tyre's*, *Dun's*, *White's Creek*, *Sam's Creek*, in Davidson County; *Winchester* and *Brown's*, in Franklin County; *Maysfield*, in Williamson; *Hager's*, in Sumner; and *Terrie's*, in Rutherford

County. All of them contain sulphuretted hydrogen and sulphate of lime, and most of them chloride of sodium. That of White's Creek has sulphates of soda and magnesia.

The quantity of sulphuretted hydrogen is from 6 to 13 cubic inches in 20 ounces of water—proportions beyond those of the White Sulphur in Virginia, and the Blue Lick in Kentucky.

Within a few minutes' walk of the city of Nashville—I speak of thirty four years ago—there is quite a strong sulphureous spring. Probably the same as that called the French Lick Spring.

I have been favored with the following memorandum from a young friend (Mr. Dashiell) from Tennessee, who is now attending a summer course of medical lectures in this city.

"*Winchester Springs*, four miles from the town of this name, are situated upon the Nashville and Chattanooga Railroad, in Franklin County, Tennessee, some seventy miles from Nashville, and fifty from Chattanooga. They are of considerable celebrity, and from their *variety* and close proximity demand a passing notice. Within a stone's throw we have four different springs; red and white sulphur, chalybeate, and *freestone.* They are all very large, and flow in full stream. They are situated in a beautiful valley, surrounded by hills covered on all sides by plants and flowers most rare. To the traveller, weary of a railroad car and fond of botanizing, no more profitable and pleasant place can he find to wile away a few days. The springs have been analyzed by the state geologist and the best chemists in Nashville, and they have been proved to possess the best qualities. The invalid in search of active medicinal waters and *bracing* air, should pay Winchester a visit.

"*Alliance Springs.*—Near the above, some four miles distant, have been discovered springs of nearly equal value and variety. They are called 'Alliance Springs,' and bid fair to become a *fashionable* resort.

"*Montvale Springs*, situated near the city of Knoxville, East Tennessee, accessible at all times, I believe, by conveyances from the city, are rich in medicinal waters of different varieties, and are much resorted to by *invalids* and pleasure-seeking people from all parts of the South. The scenery around is grand; and this region has even been called the Switzerland of America."

Warm Springs, of the temperature of 95° F., are on the French Broad River, issuing from its banks.

CHAPTER XIV.

Springs of North Carolina—The Warm and Hot Springs of Buncombe County—Springs of South Carolina—Glenn's, West's, Click's, Cowpen's.—Springs of Georgia—The Indian—Warm, of Meriwether County—Madison—How reached—Rowland's, Gordon's.

In North Carolina, the springs of which we have most heard, and those for which this State is most remarkable, are thermal. These are

The Warm and Hot Springs of Buncombe County.—Buncombe is one of the northwestern counties of the State, lying between Tennessee on the north, and South Carolina on the south. The springs are situated on the western bank of the French Broad River, and so near are they to it that in times of freshet they are overflowed by the water of this stream. The depth of the river varies at this spot; it being in some places ten to fifteen feet, in others quite shoaly. The last spring opened is twenty yards farther from the river than the others. Its temperature is not quite as great as theirs. The former is 104° F., and the latter 94° F. At the surface, the temperature of the basins supplied by the first two, is 100° F.

This is a beautiful and romantic spot, representing an extensive meadow contiguous to the river, embosomed in lofty mountains, among which the river winds. The valley seems not to exceed a mile in width, and is much narrower than this both above and below.*

The water is limpid and continually emits bubbles of nitrogen. An analysis of three quarts of the water, by Professor Smith, gave the following results:—

	Grains.
Muriates of lime and magnesia	4
Sulphate of magnesia	6
Sulphate of lime	14.5
Insoluble residue	2.5
Loss	1
Equal to but 4.66 grains in a pint	28.0

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* Professor E. D. Smith, Silliman's Journal, Vol. III.

Water of such purity may readily be taken to the extent of from three to four quarts daily, as we are told is done by visitors at the springs. After being thus freely drunk it is said, however, to exert a brisk purgative action. It then ceases to produce any sensible effect.

The bath, but without precise specification of temperature, is, we are told, taken twice daily. The time of immersion from half an hour to an hour. On these important topics I have dwelt with some emphasis, when speaking of the Virginia warm and hot springs; and to the advice and cautions laid down on that occasion, I would refer the reader. The warm bath of 94° F., at the Buncombe Springs, is pleasant, safe, and salutary to nearly all who may visit the spot. The hot bath, from 100° F. to 104° F., is, on the contrary, not only of doubtful propriety for persons in common health, but positively injurious under a great variety of circumstances in disease. Its unquestionable utility, however, in certain cases, may be inferred from what was said in a preceding chapter on the Virginia thermal waters.

Many cases of chronic rheumatism, palsy, and other kinds of weakened and impeded motion are recorded, in which a cure or great relief was obtained by the use of this water internally and externally.

Springs of South Carolina.

The geological character of the State is unfavorable to the existence of springs of very prominent mineral properties. Nevertheless there are some that have acquired considerable notoriety for medicinal virtues. Among these the most noted are Glenn's Springs, in Spartanburg District. The water of these springs is strongly charged with salts of lime.[*] Their location is a pleasant and salubrious one, and the springs are much resorted to by visitors from the lower parts of the State. Not far from this there is a chalybeate spring, known as West's Spring. Chick's Springs, a few miles above the village of Greenville, are pleasantly situated in sight of the mountains, and within a pleasant ride of the village. The water resembles that at Glenn's Springs, but is not so strongly impregnated. There are, in Abbeville District, in the Flatwoods, and near Parson's Mountains, saline and chalybeate springs, but they are not places of resort. There is another spring in the eastern side of the district at Pinson's Ford, near Dr. Jones's, which is also chalybeate and saline, and deserves a trial. In Laurens there are three or four highly chalybeate and sulphureous springs. They occur in the hornblende slates that extend from the Saluda to the Enoree, north of the village, and are worthy of notice.

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[*] Professor Shepard, of the Medical College of Charleston, says that the water of these springs "is strongly impregnated with sulphur. It contains, also, sulphate of lime (with traces of sulphate of magnesia), supercarbonate of lime and chloride of calcium."

This was the result of an analysis by Professor Shepard, and would show that the state geologist is in error.

A few miles above the village of Spartanburg, a spring occurs that has some reputation, and is a place of some resort.

Another spring of similar character is found at the foot of the Estatoe Mountains, in the upper part of Greenville, at Mr. Barton's.

At and near the furnace (Cowpens) there

are many picturesque spots as well as a chalybeate spring.—*From Report on the Geology of South Carolina, by Mr. Tuomey, State Geologist.*

Dr. Gaillard informs me that Glenn's Springs "have a considerable reputation, being particularly esteemed by the people in dyspeptic affections; which may very well be relieved by the change of scene and air, and climate, by the exercise, &c., of those who resort to them.

SPRINGS OF GEORGIA.

The only information which I have been able to procure on the mineral and thermal springs of this state is contained in the following notices, by my valued friend, Professor Richard D. Arnold, of Savannah. In his letter on the occasion, he says:—

"I find it difficult to gather any but popular information concerning them.

"First in medicinal importance stand the *Indian Springs*, in Butts County. They are sulphureous, and are much resorted to for rheumatic complaints, and for disorders dependent upon depraved digestion, whether of the liver or stomach. In both chronic hepatitis and chronic gastritis, some of my patients have been benefited most decidedly. I think very highly of their medicinal qualities.

"The *Warm Springs*, in Meriwether County, have gained very great reputation for curing rheumatism and gout. They are naturally warm, about 90° F., and hold magnesia, &c., in solution.

"From what I have learned, and from the great relief afforded to a gouty patient, whom I sent there, some six years since, I think they would prove very serviceable in podagra. Their very decided efficacy in curing rheumatism is beyond dispute.

"The *Madison Springs*, in Madison County, are purely chalybeate. They are much resorted to in cases where tonics are indicated.

"These three springs have been long established in public reputation, in this section of our Union. They are all situated on much higher elevations than the seaboard; and as far as temperature is concerned, they may challenge a competition with any mineral springs in the Union. Their elevation also secures them from malarial influences.

"You have chalybeate springs in abundance at the North, but I doubt very much if any two springs can any where be found combining such decided medicinal qualities as the Indian and the Meriwether Warm Springs. They are, also, of very easy access from the North. One of our fine sea steamers would land a patient at our wharves in sixty hours from New York, and our railroad would convey him to within sixteen miles of the Indian Springs, and about fifty of the Warm Springs. The former could be reached within four and a half days of travel from New York, and the latter within five and a half days.*

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* [In farther illustration of what Dr. Arnold writes, respecting the ease and rapidity with which these springs may be reached from the North—from Philadelphia by her steam-packet line to Savannah, as well as from New York, I append the following details of the inland route, taken from a newspaper account of the "Indian Springs:"—

From Charleston, there are several modes of access. The one generally used is by steamer to Savannah, 110 miles; thence to Macon by the Central Railroad, 191 miles; from thence to Forsyth, 25 miles, where you travel on the stage to the Springs, 16 miles—making the dis-

"Rowland's Springs, in Cass County, also a chalybeate, and Gordon's Springs, in Murray County, have lately begun to attract the attention of travellers and invalids. In Murray County, I am informed that within a stone's throw of each other, there arise four springs, each mineral, and each differing from the other. Pure limestone springs abound in the upper part of our State. I am sorry that I cannot give you any authentic analysis of any of these springs. I am not disposed to rely much on those which have been made."

tance 342 miles. By this route you can leave Charleston on one day and arrive at the Springs on the next. Another route is by railroad, via Augusta, to Covington, and thence by stage a distance of 31 miles. Or, if the traveller would wish to beguile the tedium of travelling, he can stop at Stone Mountain, by taking the train at Augusta to Atlanta. There are several fine hotels at the Springs.]

CHAPTER XV.

Springs of Alabama—Bladon—Bailey's—Mineral Artesian Wells—Springs of Mississippi—Cooper's (Artesian) Well—Ocean Springs—Their situation—Springs of Arkansas—Hot of *Ouachita* or *Washitaw*—Their situation—Between the Hot and Cold Mountains—Vapor bathing—Cold affusion—Warm bath—Composition of the water—Its resemblance to chicken broth—Diseases cured by the water—Chalybeate and Acidulous Springs—Number of the Hot Springs—Their geological relations—Warm bath in the creek—Temperature of the Springs—Adaptation of the water to certain domestic purposes—These Hot Springs resemble those of Baden, Wisbaden, Teplitz, and Carlsbad—Applicableto the same diseases—Cause of the animal flavor—Vapor bathing—Its effects and utility—Springs of Florida—Numerous but not described—Subterranean rivers—Sulphur Spring near Tampa.

SPRINGS OF ALABAMA.

THE tertiary formations of the United States are not remarkable for the mineral character of the water; yet, in the Alabama tertiary formation, there are several springs of very marked properties.

Besides numerous saline springs in a stratum associated with the burr-stone, there are others strongly impregnated with sulphuretted hydrogen. One occurs at the lower Salts, which is quite strong; and another at the upper Salt-works. Both of these are places of occasional resort for invalids.

Tallahatta Springs are well known, and much visited by citizens of that part of the State. Besides sulphur, the water contains salts of iron, lime, and magnesia.

Of all the springs of this region, those of Bladon are deservedly the most noted. The water has been analyzed by Prof. Brumby, but, as the analysis was executed at a distance from the spring, and no precautions were taken to preserve the gaseous ingredients when the water was transmitted to the professor, of course the sulphur does not appear in his analysis. One is, therefore, surprised after reading it to find the Bladon among the strongest sulphur waters in the State. The springs are pleasantly situated, and, at the proper season, very accessible from the Alabama River.

There is a strong chalybeate spring still in the tertiary formation, west of Claiborne. It is situated in the superficial beds of red loam. —*Tuomey's First Biennial Report of the Geology of Alabama.*

Bladon Springs.—"The Bladon Springs," says Hon. S. S. Houston, a member of the House of Representatives from Washington County, "are eighty-five miles from Mobile, seven from Coffeeville, in Clarke County, eight from Barryton, in Washington County, and three from Tombecbee River, between which and the springs are pine lands, with no swamp intervening. The surrounding country is much broken and diversified. The growth is pine, with an admixture of oak, hickory, &c., and it is abundantly supplied with good water. The river up to this place is always navigable for steamboats of some class, and the run from Mobile can be made in from ten to eighteen hours.

"The accommodations at the springs are now (December, 1845) sufficient for one hundred visitors, and the proprietors have erected a large hotel, which will be finished before the next season, and which will accommodate two hundred more. They are also making efforts to improve the roads leading to the springs from all points."

Six or seven fountains, differing slightly in their deposit and other characteristics, it is said, gush from the earth in a small area, furnishing abundance of water, and presenting a striking appearance.

Analysis of a wine pint:—

	Cubic Inches.
Sulphuretted hydrogen (quantity not ascertained).	
Carbonic acid gas	4.075
Chloride of sodium	0.9625
Carbonate of soda	4.1112
Carbonate of lime	0.3437
Carbonate of magnesia	0.1706
Oxide of iron	0.0300
Sulphate of lime	0.0019
Silica and alumina	0.2631
Crenic acid	0.0912
Apocrenic acid	0.0750
Loss	0.0400
	6.0892

The free carbonic acid and the relatively large proportion of carbonate of soda in this water place it among the acidulous ones. In certain forms of dyspepsia and bowel diseases, and renal affections, accompanied by heat and irritation, the Bladon waters must be valuable.*

Bailey's Spring is situated in Lauderdale County, Alabama, fourteen miles from Tuscumbia, nine from Florence, and two and a half from the stage-road leading to Nashville. The water is cool, transparent, and almost tasteless. A qualitative analysis made by Dr. Currey, of Nashville, shows it to contain carbonic acid, sulphuretted hydrogen, carbonates of soda and magnesia, oxide of iron in union with carbonic acid, chloride of sodium, and carbonate of potash. Mr. Tuomey, in his analysis of this water, found carbonates of iron and of soda, chloride of sodium, and a trace of carbonate of potash, and sulphur—the last perhaps in combination with soda as a sulphuret.

The water of this spring is extolled in dyspepsia, scrofula, and dropsy; but we have no specification of the stages or particular features of these diseases in which it is applicable, nor the quantity of the water drank to produce the desired effect.

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* The analysis of Bladon Springs was made by Professor Brumby, of the University of Alabama.

As an acidulo-sulphureous and chalybeate water, this would be adapted to a variety of functional disturbances of the digestive and renal organs, and to scrofula in its incipient, as well as in its more advanced and ulcerative stage. Nothing is said in the pamphlet before me of its action on the bowels, and we are left to infer that it is a mild alterative not wanting in therapeutic activity.

Numerous mineral waters have been obtained of late years in Alabama, by boring, with a view of getting pure potable water.

SPRINGS OF MISSISSIPPI.

Cooper's Well is four miles from Raymond, the county seat of Hinds, and twelve miles west of Jackson, the seat of government, Mississippi, on land belonging to the Rev. Preston Cooper.

The water is derived from an Artesian well dug to the depth of 107 feet in a solid sandstone rock; in some parts, a considerable conglomerate overlaying and mixed with the sandstone. At the surface, the rock is soft, but becomes quite hard at a depth beyond the reach of atmospheric action. After repeated attempts and pauses of labor, the water first flowed into the well on Friday, Sept. 16, 1841. The country around is broken and hilly, remarkably dry, and enjoying a reputation for great salubrity. It is near the Jackson Railroad.

The depth of water at the well seldom exceeds five feet. It is said to flow in, at the bottom, from three different sources, the waters of which differ from each other, so that it will be desirable, at some future period, to examine the general character of each. As it now presents itself, it is an active saline chalybeate.

Temp. of Cooper's Well water, 64° F.; the air being at 80° F.

Taste not unpleasant, and slightly mineral. *Odor*, little or none, although it is said to have a marked one of sulphuretted hydrogen: the quantity must, however, be very small. *Color*, transparent, with small yellow flakes floating on it. *Specific gravity*, 1.00147. *Gas* in a wine gallon:—

	Cubic inches.
Oxygen	6.5
Nitrogen	4.5
Carbonic acid	4.0

Solid contents of one gallon are 105 grains, composed as follows:—

	Grains.
Sulphate of soda	11.705
Sulphate of magnesia	23.280
Sulphate of lime	42.182
Sulphate of potash	0.608
Sulphate of alumina	6.120
Chloride of sodium	8.360
Chloride of calcium	4.322
Chloride of magnesium	3.480
Peroxide of iron	3.352
Crenate of lime	0.311
Crenate of silica	1.801
	105.471

The *deposit* from this water by evaporation contains, in 100 grains:—

	Grains.
Water	38
Chloride of lime	2
Sulphate of lime	25
Peroxide of iron	35

The *iron* in this water was found altogether in the yellow particles which float about, although it is more than probable that, at certain seasons of the year, it must also be found in the clear water.

The water loses none of its properties by being kept. At all times, when the effects of the iron are sought for, the sediment should be taken along with the water.

The *concentrated water* loses nothing by the process but a portion of the sulphate of lime, which is separated and adheres to the vessel.

Season for visiting the well—latter part of spring, and in the summer, and early autumn. The water is quite efficient in winter, and many invalids resort to the spot at this season.

Diseases in which Cooper's Well water is used: Chronic intestinal ones, unaccompanied with organic alterations: it is very useful in dyspepsia, inflammation of the bladder, dropsy dependent on hepatic or intestinal disease, and chronic diarrhœa.

Dr. Foster's case, reported by J. Mason Sims, M. D., Montg'y Ala.: Chronic diarrhœa in its worst form; extreme emaciation; dry skin; eyes sunken; ghastly expression; caused a female to faint at the sight of him; pulse small and feeble; discharges copious and frequent. Began by taking a wineglassful of the water four times a day, gradually increasing until he drank a pint in the course of the day. In eight weeks, returned home a well man.

Ocean Springs.—These are in Jackson Co., Lynchburg, Miss. Dr. Austin, of New Orleans, tells us, that the springs are situated among the pine hills, five miles from the town of Biloxi, and about a half mile from the eastern shore of Biloxi Bay, near Fort Bayou. This name is derived from a fort built there two centuries ago by the French, who were under the impression that the mouth of Biloxi Bay was the mouth of the Mississippi River. The bluff on this shore presents a beautiful appearance, is much higher than on the other shore of the bay, and the land is more elevated and rolling than any land on the sea coast between this place and the city of New Orleans.

Analysis.—" Water colorless, even when kept for a length of time in bottles, provided the bottles be well corked. So soon as opened, the water begins to blacken from a deposit of sulphuret of iron. The odor of the water is that of sulphuretted hydrogen, which the water contains in considerable quantity; the taste is that known to belong to this class of waters. Specific gravity, 1.00082.

Gaseous contents in one gallon:—

	Grains.
Carbonic acid	4.632
Sulphuretted hydrogen	0.481

Solid contents in one gallon:—

	Grains.
Chloride of sodium	47.770
Chloride of calcium	3.882
Chloride of magnesium	4.989
Protoxide of iron	4.712

Iodine, *a strong trace.*
Organic matter, *trace.*
Chloride of potassium, *trace.*
Alumina, *trace.*

"The iron is doubtless in combination with both the sulphuretted [hydrogen] and carbonic acid gases; the excess of carbonic acid, holding both these combinations in solution.

"The medicinal virtue of these waters is to be looked for more particularly in the oxide of iron and sulphuretted hydrogen, both of which exist in notable quantities; and it is therefore apparent that many chronic diseases might be cured, or receive important alleviation from these waters. As a bath, it could be applied with much advantage."—*J. Lawrence Smith, M. D.*

"The proximity of these springs to the city of New Orleans and the city of Mobile, being nearly equidistant (90 miles) from both places, constitutes one of its advantages, and must, from its eligibility of location, cause it to be patronized by the lovers of freedom from the foul, reeking streets of southern cities, during the summer months."

Dr. Austin, in a letter accompanying a printed account of the Ocean Springs, just made use of, writes: "Striking cures have been wrought by them in many chronic diseases—among them were affections of the skin, scrofula, dyspepsia, and strumous ophthalmia."

In ARKANSAS I shall only notice

The Hot Springs of Ouachita (*Washitaw*).—They are situated on a stream called Hot Spring Creek, which falls into the Washitaw River, eight miles below. They are fifty miles south of the Arkansas River, in Clark County, Arkansas, and six miles west of the road from Cadrin to Mount Prairie, on Red River.

The approach to the springs lies up the valley of the creek, which is partly made up of its waters. On leaving the banks of the Washitaw, the face of the country almost imperceptibly changes from a rich soil, covered with luxuriant growth of trees, to a sterile mineral tract, and on coming near the springs the traveller is presented with one of the most picturesque views in nature. On the right hand rises the Hot Mountain, with the springs issuing at its foot; on the left, the Cold Mountain, which is little more than a confused and mighty pile of stones; and the view in front is terminated by a high point of land, which makes down gradually into the valley, and separates the creek into two forks of nearly equal size.

The Hot Mountain is about three hundred feet high, rising quite steep, and presenting occasionally ledges of rocks: it terminates at top in a confused mass of broken rocks, with here and there a pine or oak tree. Its sides, notwithstanding their sterility and the steepness of their ascent, are covered with a most luxuriant growth of vines, particularly *muscadine*, the fruit of which is delicious. Haws and blackberries are also found in great abundance.

The Cold Mountain is separated from the Hot by a valley of about fifty yards wide, through which the creek flows. It resembles the other mountain in its main features, but its sides are destitute of vegetation.

The springs issue near the foot of the Hot Mountain, at an elevation of about ten feet above the level of the creek. They are numerous all along the hill-side, and the water which runs in copious streams is quite hot. It will scald the hand, and boil an egg hard in ten minutes. Dr. Anderson, of Red River, told Mr. Schoolcraft that it could not be reckoned over 200° F. There is a solitary spring seventy feet higher than the others, on the side of the mountain, but it is, also, of an equal temperature, and differs in no respect from those below. A dense fog continually hangs over the springs, and upon the side of a hill which, at a distance, looks like a number of furnaces in blast. It is probably the condensation of this vapor which produces such a rank growth of vines on the side of the mountain.

The water is clear, pure, and beautiful. It deposits no sediment by standing.

Beautiful *green* moss grows at the springs, near the edges.

I am indebted to the late Judge Watts for the following interesting account of these remarkable springs, which I here subjoin.

"*The Hot Springs of Arkansas*, or, as they are sometimes called, the *Ouachita*, are situated in Hot Spring County, Arkansas, about five miles from Ouachita (Washitaw) River, and about sixty miles from Little Rock, in a country which is very rocky, and may be called mountainous, rather from its character than from any great elevation. They are about thirty or forty in number, and some of them are very copious in their discharge, rushing out from under the rocks in a volume three feet in width by five or six inches in depth. The temperature of the springs varies from 140° to 145° (Fah.), and is sufficiently hot to scald a hog or a chicken; and the water is constantly used for these purposes.

"The mode of using the waters, most generally, is by taking a steam bath. For this purpose a small building, fifteen feet long by five feet wide, is erected. One half of it is used for an ante-room, in which to dress and undress—the other half is the bath room. The floor of the bathing room consists of slats which are two inches wide and two inches apart, and is placed over one of these large springs, which issue from the rock. The water throws off the steam, which rises between the slats. For the first three or four minutes the body is dry, but afterwards a profuse perspiration breaks out, which runs from every pore." "The temperature of the steam-room is about 116° F. This occasions no inconvenience, but for persons who apprehend a congestion of the vessels of the head, a hole is made in the roof through which a person can breathe the external air, the body being immersed in steam." "The patient usually remains thirty to forty minutes in the bathing room, and when he comes out, it is not uncommon for two or three buckets of cold water to be thrown over him in the dressing room. There is no danger of taking cold if the most ordinary precaution is used.* It is not unusual to take a steam bath in the forenoon, and a water bath in the afternoon. The water bath is frequently taken in a creek, into which all the hot springs run. After a spell of dry weather, it is necessary to go half a mile, and sometimes three-quarters of a mile below where the hot springs run into the creek, before the water is of a temperature to bathe in. If the water is carried from the spring to a bathing tub, it must stand about four hours before it can be used. * * * *

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* * * * * There have been some attempts to analyze the water, but I have no faith in any of them. The water is much impregnated with lime and magnesia,

and the deposit of these substances is very great on the mountain, and in the channels in which the water runs, and leaves and sticks are continually petrified into a kind of rotten stone, composed of lime and magnesia.

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* [Paradoxical as it may seem to those ignorant of the circumstances under which animal heat is developed, there is less danger of taking cold at this time, than if the nervous system had not been excited, and the capillaries rendered turgid by the high heat of the vapor applied to the surface. This point is fully argued and explained in my volume so often referred to in these pages, particularly in connection with the Russian vapor baths and "transition bathing."]

"The water may be drank without nausea as soon as the throat can bear it, and if a little salt be put into it, it could not be distinguished from chicken broth. The best season for the use of the water is late in the fall, and in the winter and spring. Every species of chronic disease is cured by these waters, to wit: rheumatism, gout, scrofula, venereal, mercurial, erysipelas, consequences of measles, of scarlet fever, and of whooping cough, and all diseases occasioned by obstructions.

"Three miles from the Hot Springs is a very fine chalybeate spring, and at the distance of forty miles, at a place called Irons, is a spring of highly exhilarating properties, so much so as to produce a species of intoxication.* The mode of access to the waters when the rivers are high, is by ascending the

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* [Doubtless an acidulous or highly carbonated water, probably holding in solution carbonates of soda and lime.]

Arkansas to Little Rock, sixty miles from which the springs are situated; but as the Arkansas is not always navigable, there is a route by way of White River, to Rock Row, from thence by stage sixty miles to Little Rock. This route is always accessible."

Dr. Bennet Dowler, the enthusiastic investigator of physiological and pathological phenomena, was kind enough to answer my request to him for information, by the following valuable details:—

"The therapeutic value of these Hot Springs is held in high estimation in the South, and many cases have been reported, verbally, among the non-professional public, although most persons regard the efficacy of the waters as depending chiefly or entirely upon their temperature. They are regarded as most useful in rheumatism, contraction of the limbs, cutaneous diseases, &c. They are used not only externally, but internally.

"The number of these hot springs arising near each other, from the declivity, near the bases of two opposite hills (400 or 500 feet high), has been variously stated. Dr. Henderson, of New Orleans, counted seventy-five, Judge Watts, of this city, reckons about thirty. The number given by the Rev. T. Flint, the late able geographer of the Valley of the Mississippi, agrees with the latter. Mr. Flint says that the valley where these springs arise runs north and south, conveying in a southern direction a small stream to the Washita River, seven miles distant; that thirty springs arise on the east side of this valley, and but one on the west, and that the water hardens an egg in fifteen minutes.

"Mr. Featherstonhaugh, in his official Geological Report, in 1835, says that these lofty ridges consist of old red sandstone formation. The eastern ridge has towards the top a dense forest of pines and oaks, fragments of the rock, often ferruginous, with conglomerate held together by ferruginous cement; upon the flank of this ridge, Mr. F. found travertin, deposited by the mineral waters, extending one hundred and fifty yards, leaning upon the acclivity of the old red sandstone, presenting sometimes abrupt escarpments of from fifteen to twenty-five feet. 'Some of the springs, he says, rise in the bed of the stream—one very fine one on its west bank, and numerous others, of which perhaps 30 rather copious ones are found at various heights on the ridge, rising through the old red sandstone. Of springs of feebler force there are a great many. Some issue from the rock at an elevation of at least one hundred feet from the valley where the present log cabins are built. A more beautiful and singularly convenient situation for a town cannot be imagined, for by the aid of the simplest frames to support spouts, the hot water may be conveyed to the houses in great profusion, for baths and medicinal purposes, as well as for domestic uses. (These arrangements have, as Dr. D. learns, been made.) Upon repeated trials, I found the water of some of the principal springs to be 146° F., never higher.' From the Hot Springs occupying a breadth equal to four hundred yards of the base of the ridge, all the hot water was discharged into the creek, which, in many parts, was of a temperature just fitted for a warm bath; and what further assists to keep up its temperature, is the great number of hot springs rising through the slate at the bottom of the brook. 'This can be seen at almost a hundred places, and although the water does not scald the hand there, still, upon insinuating my fingers a few inches below the ground, at the edge of the stream, I was obliged to retire them instantly, having more than once burned them in that way. If this stream were turned, it is incredible the quantity of water of a temperature perhaps always equal to 145° F., which might be obtained. These mineral hot waters, except one or two of the springs, which are slightly chalybeates, are tasteless, having not the least saline trace; but immense deposits of the carbonate of lime attest the contrary. The thermal waters rise in a very limpid state, but as soon as they get into motion, and their parts become exposed to the atmosphere, a mineral deposit commences, attaching itself to dead leaves, to sticks, to anything that serves for a point of adhesion; upon this deposit a brilliant green enamelled looking substance presents itself, which increases and thickens in favorable situations.' Mr. F. did not analyze these waters, though he says 'their gaseous volume is insignificant—azote and a trace of carbonic acid. The solid contents are carbonate of lime, carbonate of iron, and a trace of the sulphate of lime.'

"Dr. Cartwright, late of Natchez, now of New Orleans, informs me that he has obtained magnets of uncommon power from these springs.

"A correspondent of Professor Silliman's Journal represents the temperature of the springs as ranging from 154° to 156° F., in July, 1837, that they discharge from one barrel to fifty gallons of water per minute. and that their latitude is 34° 30′ N.

"Several persons have assured me that the temperature of the water is exactly adapted to those processes of domestic economy called scalding hogs, fowls, &c.; and that, at certain seasons and places, the hot water having entered the brook, and overlying the cold water of the latter, does not prevent fish from living in the lower stratum."

The Hot Springs of Washitaw are, as respects elevated temperature, in the same class with the famed ones of Baden-Baden, Wisbaden, Teplitz, and Carlsbad,* and nearly all that is said of the curative powers of these waters, when used as a bath, is applicable to our own. The same precautions are necessary in the one case as the other, when recourse is had to a bath at a temperature beyond 100° F., and still more when it approaches the upward limits of what can be barely borne on immersion in the Washitaw waters. Persons in confirmed phthisis, or who have suffered from hemorrhages, or who at the time have hemorrhoids, the plethoric, with fulness of the vessels of the head, and in fine all who are laboring under acute disease of any description, must shun the use of these waters at their higher temperature.

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* The celebrated Unsprung, at Baden-Baden, is 154° F. A pint of the water contains 23 grains of saline matter, of which 16 grains are chloride of sodium. Five or six glasses, in all about two pints and a half of the water, are drunk, at intervals, before breakfast. The chief reliance, however, is on the baths, the indiscriminate use of which has been productive of fatal effects in some cases.

The Carlsbad Springs (in Bohemia) are fourteen in number, of which the Sprudel is the hottest and the most famous. Its temperature is 168° F., that of two others 144° and 137° F. The water holds in solution 44 grains of solid matters to a pint, 37 grains of which consist of the sulphates, carbonates, and muriates of soda, with traces of iron and iodine. The taste of the water very much resembles that of weak chicken broth, with a flat and alkaline savor. As a drink it must be taken at first in small quantities. It is now used more internally than externally.

The Teplitz Springs (in Bohemia) have a range of temperature from 84° F. to 120°. Their chief ingredient is carbonate of soda, in the proportion of two or three grains to a pint. The long ranges of bath-houses, both public and private, are on a grand scale. At Washitaw there is every inducement to rival Teplitz in these structures, and if, as a writer has said, there ought to be a mart at this Bohemian watering place for the sale of crutches which are no longer needed, we may readily see that the day will come when a second-hand shop for the same purpose may be set up at our Arkansas Springs.

On the other hand, recourse to them will be had with considerable confidence in paralysis, and in chronic rheumatism and gout, in biliary and renal calculi, constipation, chronic enlargements of the liver and spleen, chronic cutaneous diseases, obstructed or suspended menstruation, and in a variety of nervous affections. In all these cases the internal use of the water should be conjoined with its employment as a bath.

With the abundant supply of hot water from the numerous springs at Washitaw, it would be an easy matter to have every variety of baths on a large scale, viz: A piscina or swimming bath,a leukerbad, if it were desirable, and douches after every model of temperature, size, and force.

The soup-like taste of this water, mentioned by Judge Watts, is the same as that described by visitors to some of the German Spas, and proceeds from the same cause, viz: the azotized or organic matter which they contain, and to which reference has been already made, when speaking of the Blue Sulphur Spring, in Virginia.

An extensive suite of vapor baths might be made at the Washitaw Springs, so as to allow of the use of this active means of cure of many diseases, both alone and in connection with other forms of bathing. The temperature of the vapor introduced into the somewhat primitive bath, as described by Judge Watts, is as high as at any time necessary, and higher than is required or proper in most cases. A vapor bath, at 100° F. will answer most purposes, unless it be desired to produce strong excitement. At a lower degree, as 90° F., it will be found to be a very soothing remedy in diseases of irritation, and even inflammatory excitement. On all the points connected with the uses of vapor bathing, and its application to different diseases, I have written with some fulness in my volume on *Baths*, &c. I will merely repeat what is there said of its physiological action, as suggestive of its therapeutical application and the various indications which it may be supposed to meet.

"The inert and partially collapsed capillary vessels of the true skin acquire more vitality and fulness from the afflux of blood to them, in consequence of the heat of the vapor, and they are more ready to supply the secretion of sweat. There is, at the same time, a large imbibition of moisture, and consequently augmented size of the lymphatic and venous absorbents. We have then two conditions, viz: fulness of the arterial capillaries by afflux of blood, and fulness of the absorbents by the watery fluid introduced, which give a plumpness and roundness to the skin and cellular tissue, observed in those who have just left the bath."

Florida can boast of her more than two thousand Mineral and Thermal Springs, on the authority of a writer, some time back, in the Floridian Journal. As yet, however, it is all boast, as far as anything like a detailed knowledge of the alleged fact is possessed by others than the writer himself. He tells us, indeed, that their principal solid contents are the sulphates of lime, magnesia, and soda, oxide of iron and some iron. Their volatile ingredients consist of sulphuretted hydrogen, carbonic acid and nitrogen gases. I should feel greatly indebted to this gentleman, and to others resident in different parts of Florida, by their communicating to me authentic details in their possession, or procurable by them, on this confessedly very important subject.

The writer referred to speaks of the "Natural wonders" of the State, especially under the hydrographic head. He says, "The upper stratum of Florida rests on one vast network of irregular arches of stupendous magnitude, through which innumerable rivers, creeks, and mineral waters, in silent darkness perpetually flow. Walkulla, Ocilla, Warcissa, Crystal, Homosassa, Chesiouitska, Wickawatcha, and Silver Spring, are the principal rivers. The creeks of this denomination are too numerous to mention; most of them afford fine mill-sites. They are, too, partly or wholly navigable for the smaller class of steam and sail vessels throughout the entire distance of their subterraneous courses. Those that are not can be made so with comparatively small trouble and little expense."

Sulphur Spring near Tampa.—This spring, which is a white sulphur, bubbles up from the crevices of limestone, about a hundred yards up a tributary of the Hillsborough River, and eight miles up this latter. It forms a basin eighteen feet deep, the water of which is very limpid.

Mention may be made, also, of the Magnolia,* the Walake, and the Enterprise Springs, on St. John's River; and those on the Suwannee—all sulphureous.

*** Dr. N. Benedict, formerly of Philadelphia, and afterwards of Utica (N. Y.), well and advantageously known in both places, has established a *sanatarium* at Magnolia, for the reception of invalids who wish to spend the winter in a southern climate.**

CHAPTER XVI.

Mineral and Thermal Springs between the Mississippi and Pacific Ocean—Thermal Spring of Fort Laramie—Situation of the fort—Soda or Sal Æratus Ponds—Beer Springs on Bear River—Their situation and temperature—Analysis—Hillocks formed by the waters—Steamboat Spring—Why so called—Properties of its water—Other like springs adjoining—Extinct volcano near the Beer Springs—Boiling (Acidulous) Springs of Pike's Peak—Analysis of Saline accumulations at this spot—Temperature of the water.

MINERAL AND THERMAL SPRINGS BETWEEN THE MISSISSIPPI AND THE PACIFIC OCEAN.

The vast regions extending from 95° W. long., or from the western limits of Iowa, Missouri and Arkansas, to the Pacific Ocean, are remarkable, among other great natural traits, for the number and variety of their mineral and thermal springs. Some of these are in the territories of Nebraska, Kansas, and New Mexico; many in Oregon, and in Utah around the Great Salt Lake, and not a few in California.

Thermal Spring of Fort Laramie.—This spring, mentioned by Captains Fremont and Stansbury, in their respective narratives, is situated in a narrow defile, being the bed of a creek, shaded by precipitous rocks, ten miles west from Fort Laramie. It gushes with considerable noise and force out of a limestone rock, and soon forms a small stream called Warm Spring Creek. Temperature 74° F., which is that of the Sweet Springs in Virginia. The land about here is table, and lies between the North Fork of the Platte, and the Laramie Rivers.

Fort Laramie itself is in 104° 47′ W. lon., and about 42° 15′ N. lat., distant one and a half miles from the Platte River, at the end of the Laramie Valley, and 625 miles from St. Joseph's, on the western limits of Missouri. It is in the southern part of Nebraska, and on the great emigrant route to Oregon, on the projected line of the Central Railroad to the Pacific.

Ponds of Sal Æratus.—Still in Nebraska, near to the Oregon line, and between Rock Independence on the east, and South Pass on the west, are found three ponds, on extensive salt plains, in the valley of the Sweet Water River, above the Devil's Gate, where it breaks through the mountains. To be more specific, it ought to be said, that here the traveller meets with saline incrustations, and solutions of sesquicarbonate of soda, and muriate and sulphate of soda, in proportions not yet determined. These salts thus combined, are found in the Natron lakes of Hungary, Africa, and other countries. The chief of these ponds appeared to Captain Stansbury as if frozen over, and covered with a very light fall of drifting snow. It was found to be a slight depression about 400 yards long, by 150 in width, covered with an efflorescence of carbonate of soda, left by the evaporation of the water which had held it in solution. This substance is quite abundant on the banks of the river, and it is used by the emigrants for making their bread, in preference to the sal æratus of the shops.

Soda or Beer (Carbonated) Springs.—Continuing on the great emigrant route to Oregon and the Pacific, along the north fork of Platte River, and having passed Rock Independence, the traveller finds himself at the South Pass, called by Fremont, "the great gate through which commerce and travelling may hereafter pass between the Valley of the Mississippi and the North Pacific." Its elevation above the Gulf of Mexico is 7,490 feet, and its width 20 miles. Being distant from the mouth of Oregon River about 1400 miles, by the commonly travelled route, it may be assumed to be about half-way between the Mississippi and the Pacific Ocean, still on this route. The South Pass is through the Wind River Mountains, a part of the great range of the Rocky Mountains which separate the waters flowing into the Atlantic from those that find their way into the Pacific.

We are now in Oregon, at its southeastern angle and not far from the northern boundary of Utah. Were a direct line to be followed northwest from the Pass, it would lead, at a distance of about one hundred and thirty miles, to the remarkable Beer Springs. Following the emigrant route and that taken by Captain Fremont and his party, which goes far south, touching on the Green River, the distance to the valley of Bear River is 185 miles, and thence to the springs near one hundred more.

The *Beer Springs* are in an amphitheatre of mineral waters, which is inclosed by the mountains that sweep around a circular bend of the Bear River, at its most northern point in the territory of Oregon. This stream, which so far had pursued a northern course, now takes a southern direction, and ultimately empties into the *Great Salt Lake.* We shall again meet with it in our thermal and hydrological tour round the lake. "In the bed of the river for a space of several hundred yards, these springs are very abundant; the effervescing gas rising up and agitating the waters in countless bubbling columns." This effervescence and their acidulous taste caused the first voyageurs and trappers to call them Beer Springs. They were often half hidden by tufts of grass, which Capt. F. and his party amused themselves in removing, and searching about for more highly impregnated waters. Some of them are deep and of various sizes, sometimes several yards in diameter. A grove of cedars adjoins the springs.

The temperature of the water of the largest spring was, at sunset, 65° F., at an elevation of 5,840 feet, that of the air being 62.°5 F. They are in 42° 40′ N. lat., and 111° 46′ W. long. On the following morning, at sunrise, the temperature of the same water was 56°, that of the air being 28.°5 F. An analysis of one quart of water of the Beer Spring, as reported in Col. Fremont's Report, yielded the following results:—

Sulphate of magnesia	12.10
Sulphate of lime	2.12
Carbonate of lime	3.86
Carbonate of magnesia	3.22
Chloride of calcium	1.33
Chloride of magnesium	1.12
Chloride of sodium	2.24
Vegetable extractive matter	0.85
	26.84

The carbonic acid had escaped from the water before the analysis was made. The proportion of the gas is doubtless very considerable.

Captain Fremont, in wandering through the cedar grove which was the seat of his encampment, in the bottom towards the mountain, noticed saline efflorescences, and a number of regularly shaped and very remarkable hillocks. These latter have been formed by the gradual deposit from the waters of extinct springs, the orifices through which they found issue being still visible at the summits. Some of them resemble funnel-shaped cones. At another spot, a little higher up the meadow, he saw several remarkable white and red hillocks, which are immediately on a small stream that flows into Bear River. They are formed like the ones just mentioned, but the openings on their summits were much larger, so as to resemble miniature craters, and some of them were several feet in diameter. At the foot of one of the hillocks, or rather on its side near the base, are several small limestone columns, about one foot in diameter at the base, and tapering upwards to a height of three or four feet. On the summit the water is seen boiling and bubbling up, and constantly adding to the height of the little columns.

Steamboat Spring.—In the vicinity of the Beer Springs were numerous other ones of an entirely different and equally marked character, which remind us of the Geysers, and other volcanic phenomena of Iceland.

"In the vicinity around were numerous springs of an entirely different and equally marked character. In a rather picturesque spot about 1,300 yards below our encampment, and immediately on the river bank, is the most remarkable spring of the place. From the opening in the rock, a whole column of scattered water is thrown up in the form of a *jet d'eau*, to a variable height of about three feet; and though it is maintained in a constant supply, its greatest height is attained only at regular intervals, according to the action of the force below. It is accompanied by a subterranean noise, which, together with the motion of the water, makes very much the impression of a steamboat in motion, and without knowing that it had been previously so called, we gave to it the name of the *Steamboat Spring*. The rock through which it is forced is slightly raised in a curved manner, and at its mouth presents an urn-like appearance. It is evidently formed by a continued deposit from the water, and is colored bright by oxide of iron." The chemical composition of the water may be inferred from that of the deposit, an analysis of which is subjoined.* This is a thermal spring. Temperature 87° F. "The water has a pungent and disagreeable metallic taste, leaving a burning effect on the tongue.

"Within perhaps two yards of the *jet d'eau* is a small hole of about an inch in diameter, through which, at regular intervals, escapes a blast of hot air, with a light wreath of smoke, accompanied by a regular noise." The inhaling of this vapor (probably carbonic acid gas) produces a sensation of giddiness and nausea.

"A short distance above the spring, and near the foot of the same spur, is a very remarkable colored rock, soft and friable, con-

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* Carbonate of lime	92.55
Carbonate of magnesia	0.42
Oxide of iron	1.05
Silica Alumina, Water and Loss	5.98
	100.00

sisting, principally, of carbonate of lime and oxide of iron, of regular structure, which is probably fossil coral."

Walking near one of the remarkable red colored hills previously described, close to the encampment, Fremont had his attention attracted by a subterranean noise around which he circled repeatedly, until he found the precise spot whence it came. On removing the red earth, he discovered a previously hidden spring, which was boiling up with force: the water has the same disagreeable metallic taste as that of the Steamboat Spring. In some of the columnar fountains of which notice has been already taken, the water boils up, but no longer overflows. It has the same taste as that just mentioned.

A little higher up the small stream or creek, previously adverted to, its banks are formed by strata of a very heavy and hard micaceous basalt, having a bright metallic lustre when broken. In this direction, at the foot of a mountain spur, the traveller so often quoted, saw issuing from a compact rock of a dark blue color, a great number of springs having the same pungent and disagreeable metallic taste already mentioned, and the water of which was collected into a very remarkable basin, the bottom and sides of which were composed of an interweaving of mosses three or four, and sometimes ten feet high, incrusted and cemented by the calcareous deposit from the water itself. The basin is, perhaps, fifty yards in circumference, and three or four feet deep. Below this, again, is another basin of very clear water, and apparently of considerable depth, from the bottom of which gas was largely evolved. The overflowing water was collected into a small stream, which, after a few hundred yards, sank under ground, reappearing among the rocks between the two great springs, near the river into which it flowed, while forming a little cascade.

A little to the west of the Beer Spring is an isolated hill, terminated by "a very perfect crater, of an oval or nearly circular form, three hundred and sixty paces in circumference, and sixty feet at its greatest depth. The thin and stony soil of the plain adjoining, was entirely underlaid by the basalt which forms the walls of the river, distant two miles."

The Carbonated or Boiling Springs of Pike's Peak.—If from the mouth of the Kansas, at Independence, in Missouri, we take the southern route for Oregon and California, we soon come to Pike's Peak, after passing through Puebla. Ten miles from this place, and at the foot of the Peak, break out the Carbonated or Boiling Springs, near the head of the river of this name. They are at an elevation of 6,350 feet above the ocean, in lat. 38° 52′ N., and long. 105° 22′ W.; and are situated on both sides of the river: on one side there are two different localities in which they appear—an upper and a lower. Capt. Fremont describes the spot and his approach to it in the following terms:—*

"I came suddenly upon a large, smooth rock about twenty yards in diameter, where the water from several springs was bubbling and boiling up in the midst of a white incrustation, with which it had covered a portion of the rock. As this did not correspond with a description given me by the hunters, I did not stop to taste the water, but, dismounting, walked a little way up the river, already become a torrent, foaming along, and broken by a small fall. A deer which had been drinking at the spring, was startled by my approach, and springing across the river, bounded off up the mountain. In the upper part of the rock, which had, apparently, been formed by deposition, was a beautiful white basin, overhung by currant bushes, in which the cold, clear water bubbled up, in constant motion by the escaping gas, and overflowing the rock, which it had almost entirely covered with a smooth crust of glistening white."

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* A Report of the Exploring Expedition to the Rocky Mountains and to Oregon and North California.

The springs on the opposite side of the river are entirely of the same nature.

The water is highly carbonated, and ranks in the acidulous class. It was represented by Mr. Preuss, a companion of Capt. Fremont, to resemble very much that of the famous Seltzer Springs, in the Grand Duchy of Nassau. It is still more agreeable than that of the famous Beer Springs.

The incrustation with which the water had covered a piece of wood lying on the rock, was composed of the following saline substances:—

Carbonate of lime	92.25
Carbonate of magnesia	1.21
Sulphate of lime Chloride of calcium Chloride of magnesium	.23
Silica	1.50
Vegetable matter	.20
Moisture and loss	4.61
	100.00

The temperature, early in the morning, July 19th, of the lower spring was 57.°8, and that of the upper 54.°3 F. On the preceding day, when the temperature of the air was 73° F., that of the two springs in the sun was, respectively, 60.°5, and 69° F.

CHAPTER XVII.

Springs in Utah and around the Great Salt Lake—Sulphur Springs of Bitter Creek—City of the Great Salt Lake—Its situation—Copious supply of water—City Warm Sulphur Spring—Hot Spring—Warm Fountains—Hot Chalybeate Red Springs—Analysis of their deposit—Bear River Hot Spring—Salt and Sulphur Springs—Thermal and Saline Springs—Spring Valley and Thermal Saline Springs—Warm Springs of Lake Utah—Water of the Great Salt Lake.

MINERAL AND THERMAL SPRINGS NEAR THE GREAT SALT LAKE IN UTAH.

ON the route from the east through Utah, the traveller meets with two *Sulphur Springs*. These are near a fork of Bitter Creek. Arrived at the lake, we will suppose him to visit the Mormon city of the Great Salt Lake, the capital of what its people call Deseret, we Utah. Situated as the Mormons are, in a region of thermal springs, we may expect to see them imitate the Turks and other oriental nations in the number of their baths, and their fondness for thermal bathing, as they have already imitated them in their habits of polygamy.

The Great Salt Lake City, as described by Captain Stansbury,* is nine miles south-east of the lake, and between it and the Utah Lake, from which last it is distant 25 miles. The city is on the river Jordan, which connects the two lakes by flowing from the Salt Lake to the Utah. It lies at the western base of the Wahsatch Mountains, in a curve formed by a projection westward of the main range. This city is interesting in a hydrographical point of view. On the east it is washed by the waters of the Jordan, while to the southward, for twenty-five miles, extends a broad level plain, watered by several little streams, which, flowing down the eastern hills, form the great elements of wealth of the community. Through the city itself flows an unfailing stream of pure sweet water, which, by an ingenious mode of irrigation, is made to traverse each side of every street, whence it is led into every garden spot, spreading life, and verdure, and beauty over what was heretofore a barren waste.

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* **Expedition to the Great Salt Lake.**

City Warm Sulphur Spring.—Already the water of this spring, which issues from a mountain on the northern confines of the city, has been conducted by pipes into a commodious bathing-house for the use of the inhabitants.

The water is sulphureous, being strongly impregnated with sulphuretted hydrogen. The solid contents, after evaporation, were a very minute proportion of chloride of calcium, carbonates of lime and magnesia, and sulphate of soda, with only one per cent. of chloride of sodium.

Hot Spring.—At the western point of the same spur of the mountain just noticed, three miles distant, another spring flows in a bold stream from beneath a perpendicular rock, with a temperature of 128° F., too high to admit of the immersion of the hand. At the base of the hill it forms a little lake, which in the autumn and winter, is covered with large flocks of water-fowl, attracted by the genial atmosphere of the water. Its specific gravity is very slightly more than that of distilled water. The solid contents in one hundred pints were 1.1454. It contains, as we learn from Dr. Gale, chloride of sodium, one in a hundred parts, and shows traces of chlorides of magnesium and of calcium, carbonate and sulphate of lime and silica: these last two in the same proportion.

Warm Fountains.—On the eastern side of the lake, near the city, between the latter and the Hot Spring, are, Lieutenant Gunnison tells us, numerous warm fountains, which deposit gypsum, and other sulphates. These waters give delightful baths, but they destroy the fertility of the soil.

Hot Chalybeate Red Springs.—Thirty-four miles north of the city, these springs issue from the spur of a mountain range on the east side of the lake, and between Ogden City on the south, and Bright Creek on the north. To the east of them is the mountain range. The Red Springs derive their name from the iron which they deposit, and which colors the ground with a deep crimson. Salt flats extend from the lake to this point.

These are, most probably, the springs of which Fremont speaks, as follows: "In about seven miles from Clear Creek, the trail brought us to a place at the foot of the mountain, where there issued, with considerable force, ten or twelve hot springs, highly impregnated with salt. In one of them the thermometer stood at 136°, and in another at 132° 5′ F., and the water which spread in pools over the low ground, was colored red." (p. 150.) At the time of this adventurous traveller's visit, there was no city, no habitation, nor the voice of a single civilized being to be heard on the shores of the Great Lake; so that we derive no aid by bearings from the city of any of the springs which he describes, as is the case with some of those noticed by Stansbury and Gunnison.

Fremont furnishes an analysis of the red earthy matter deposited in the bed of the stream made by the springs, which gave the following result:—

	Grains.
Peroxide of iron	33.50
Carbonate of magnesia	2.40
Carbonate of lime	50.43
Sulphate of lime	2.00
Chloride of sodium	3.45
Silica and alumina	3.00
Water and loss	5.22
	100.00

Bear River Hot and Warm Springs.—Near the Bear River, and within a few feet of each other, are springs which Gunnison describes as issuing between different strata of conglomerate and limestone. One of them is a hot sulphur, the second warm and salt, and the third cool, drinkable water. They issue at the foot of a flanking terrace of hills, twelve miles below the "gates," where the Bear River breaks through the Wahsatch range; and they have excavated for themselves a circular pool, fifteen feet deep, with sloping sides, and a deep channel leading into a meadow. At numerous places fine salt is brought up and jets of gas are emitted. The salt forms an incrustation around the pool, and is pure enough for table use.*

These are, it seems to me, the same thermal springs noticed by Fremont (p. 159), when he ascended for a short distance the valley of Bear River, from the lake. "Continuing," he says, "along the foot of these hills, in the afternoon we found five or six hot springs gushing out together, beneath a conglomerate, consisting principally of fragments of a grayish-blue limestone, efflorescing a salt upon the surface. The temperature of these springs was 134° F., and the rocks in the bed were colored with a red deposit, and there was common salt crystallized on the margin. There was, also, a white incrustation upon leaves and roots, consisting principally of carbonate of lime." Lat. 41° 42′ N., long. 112° 05′ W.

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* Lieut. Gunnison.—Report to Captain Stansbury, in "Expedition to the Great Salt Lake."

Salt and Sulphur Springs.—Numerous salt and sulphur springs break out from the bank of the southern extremity of the rocky range where it juts into the northern end of the lake. The strata here are contorted, and in some places nearly perpendicular.

Thermal Saline Springs.—Stansbury speaks of what he calls a *Warm Saline*, of 74° F., breaking out from the mountain, at the prairie on the northern end of the lake, and of another so-called *Warm Spring*, with a temperature of 84° F. Independently of the common mistake of designating as warm any spring the water of which is at a sensibly higher temperature than that of the common springs of the region of country in which it is found, the leader and authors of the "Expedition" may find a natural excuse in the fact, that when they made their observations, the temperature of the air was 30° F., or two degrees below freezing point. It may easily be conceived, therefore, that persons engaged in a survey, with their fingers cold, if not benumbed by the frosty air, should experience a grateful sensation approaching to that of warmth, by immersion of these members in water at 84° and even 74° F.

The whole western shore of the Salt Lake is bounded by an immense level plain, consisting of soft mud, often partially traversed by small meandering rills of salt and sulphureous water, and occasionally by springs of fresh water, all of which sink into the earth, or are absorbed and evaporated before they reach the lake. There are Salt Pools near Deer Creek.

Spring Valley—Thermal Saline Springs.——On the western side of the mountain which extends in a southerly direction, from near the south end of the Salt Lake, and at the edge of the prairie, are springs so numerous as to give a name to the valley. They are all saline. Temperature 74° F. Near the northern point of the mountain is a very large spring, which discharges its waters into the lake. The water was very salt, nauseous, and bitter, with a temperature of 70° F., notwithstanding which it swarmed with innumerable small fish, and seemed to be a favorite resort for pelicans and gulls.

Near Spring Valley, on the east, but separated from it by mountain ridges, is Tuilla Valley, as it is called by the Mormons. Here is excellent pasturage for numerous herds of cattle, which are wintered under the charge of keepers.

Warm Springs of Lake Utah.—Near to the junction of the River Jordan with the lake are warm springs.

Water of the Great Salt Lake.—This water has been examined by Dr. Gale (Washington City). It was perfectly clear, and had a specific gravity of 1.170, water being 1.000. One hundred parts, by weight, evaporated to dryness in a sand bath, gave of solid contents 22.422, consisting of chloride of sodium 20.196, sulphate of soda 1.834, chloride of magnesium 0.252, chloride of calcium, a trace.

The water of this lake is declared by Dr. Gale to be one of the purest and most concentrated brines in the world. The strongest of the salines in the state of New York—that of Syracuse—contains 17.35 per cent. of chloride of sodium.

CHAPTER XVIII.

Fort Hall—American Falls of Snake River—Fishing Falls —Hot Springs—Malheur River Hot Springs—Soda and Salt Plain—Hot and Warm Springs of Fall River—Hot Springs of Pyramid Lake—Springs of California —Hot Spring of Shasty Peak—Acidulo-Chalybeate Spring of Shasty Peak—Volcanic Springs—Earthquake—Spouting Springs—Hot Sulphur Springs—Springs of New Mexico—Ojo Caliente.

Taking the Beer Springs as his point of departure, the emigrant or traveller, who is bound for the mouth of the Columbia River, will proceed in a north-westerly direction to Fort Hall, a distance of fifty miles. The fort is in a rich valley, 21 miles long, near the confluence of the Pont Neuf River with Snake River, or, as it is often called, Lewis's Fork of the Columbia, which takes place about nine miles below the fort. Before long, in continuing down the valley of Snake River, we come to the American Falls. The river, which just above was

870 yards, or nearly half a mile wide, is here narrowed in the form of a lock, by jutting piles of scoriaceous basalt, breaking over which the foaming waters must present a grand appearance after heavy rains. Along the whole line of the course of the river, from some distance above the falls, to the Dalles of the Lower Columbia, its bed resembles a chasm which had been made by subterranean violence, and which seems to have directed the course of the waters flowing in this direction. The next natural curiosity on the route is the bursting out of a subterranean river from the face of an escarpment, and its fall, in a white foam, into the larger Snake River below. After this comes the Fishing Falls, "a series of cataracts, with very inclined planes, which are probably so named because they form a barrier to the ascent of the salmon; and the great fisheries, from which the inhabitants of this barren region almost entirely derive a subsistence, begin at this place." Fifty to sixty miles farther, in a northwesterly direction, or about 230 miles from Fort Hall, we come to a group of

Hot Springs.—The temperature of the water was 164° F. "The rocks were covered with a red and white incrustation, and the water produces on the tongue the same unpleasant effect as that of the Basin Spring, on Bear River. The springs have several issues, and bubble up with force enough to raise the small pebbles several inches."

The following is an analysis of the deposit with which the rocks are incrusted:—

Silica	72.55
Carbonate of lime	14.60
Carbonate of magnesia	1.20
Oxide of iron	4.65
Alumina	0.70
Chloride of sodium, &c.	1.10
Sulphate of soda	
Sulphate of lime, &c.	
Organic vegetable matter	5.20
Water and loss	
	100.00

In the expulsive force with which the water is ejected, and in the composition of the substances held in solution, we see, at this spot, phenomena closely analogous to those manifested by the Iceland springs.

The road before reaching the springs was extremely rocky, and exhibited hard volcanic fragments; and the rocks at the foot of the ridge near to which they issue have the appearance of a reddish-brown trap, fragments of which were scattered along the road from the springs. The ridge here mentioned is probably a spur from the Salmon River range, and is about five miles north of the Snake River, in lat. 42° 10′ N., and long. 115° 10′ W.

Malheur River Hot Springs.—At a travelled distance of about 120 miles, in a northwesterly direction from the Hot Springs, last mentioned, we come to these in lat. 44° 17′ N., and long. 117° W. I have designated them after the name of the river (*Rivière aux Malheurs*), on the low bank of the right side of which they are situated. They are numerous, and have the very high temperature of 193° F. "The ground, which was too hot for the naked feet, was covered above and below the springs with an incrustation of common salt, very white, and good and fine grained. Elevation above the sea, 1,880 feet.

Soda and Salt Plain.—On approaching the Blue Mountains, in his journey west, Fremont met with "the bed of a dry salt lake or marsh, very firm and bare, and which was covered thickly with a fine white powder, containing a large quantity of carbonate of soda (thirty-three in a hundred parts)."

The next hot springs to be mentioned in Oregon are west-northwest of the last mentioned group on Malheur River, and separated from them by four degrees of longitude. These two groups of springs are on opposite sides of the Great Basin, Desert some call it, which has an elevation above the sea of four to five thousand feet, and is surrounded by lofty mountains. It is believed, says Col. Fremont, to be filled with rivers and lakes which have no communication with the sea; deserts and oases which have never been explored, and savage tribes which no traveller has seen or described.

The distance in a direct line, from the Springs of Malheur River, on the east, to those of Fall River now to be mentioned on the west, is about two hundred miles; but the traveller's route, that taken by Fremont in his journey of exploration, was much longer, and, of course, more circuitous, viz: north along the mountains to the Columbia River, down it to near the Falls and the Cascade Range, and up the Fall River, skirting this range in a southerly course, until, coming on a tributary stream, he found the

Hot and Warm Springs of Fall River.—They are on both sides of the branch of the Fall River, in about lat. 44° 40′ N., and long. 121° 5′ W. Those on the left bank, which were formed into deep handsome basins, would, in a more genial air than that which the travellers were then encountering, make delightful baths. Their temperature was 89° F. The others on the opposite side of the stream, at the foot of an escarpment, were 134° F. These waters deposited around the spring a brecciated mass of quartz and feldspar, much of it of a reddish color. From near this spot, on an elevated plain, a view is obtained of six great peaks; the first being Mount Jefferson, on the Cascade Range. The whole of this region exhibits strongly marked volcanic features.

Following up, in nearly a due south course, the Fall River, and sometimes crossing its branches, the travellers reached a savannah or grassy meadow, called Lake Tlamath or Klamet, through which flows a river of the same name to the ocean. After the melting of snow from the neighboring mountains, the surface of the lake is partly studded with ponds and marshes, which are dried up on the approach of warm weather. Thence the road was to the head waters of the Sacramento River, which empties into the Bay of San Francisco, and across the Winter Ridge to the Summer Lake. Still continuing their course, in a southerly direction, along the eastern base of the Sierra Nevada range, Fremont and his party, sometimes in the mountains, sometimes skirting them, met with a succession of lakes, from Abert to Mud Lakes, with Christmas one intervening. Between Mud and the next and larger lake, called Pyramid, are seen, to use the words of Fremont, "the most extraordinary locality of hot springs we have met during the journey." I shall give his description of them under the title of the

Hot Springs of Pyramid Lake.—"The basin of the largest one has a circumference of several hundred feet, but there is at one extremity a circular spot of about fifteen feet in diameter, entirely occupied by the boiling water. It boils up at irregular intervals and with much noise. The water is clear, and the spring deep; a pole about sixteen feet long was easily immersed in the centre, but it gave no evidence of the depth. It was surrounded on the margin with a border of *green* grass, and near the same the temperature was 206° F. By agitating the water with the pole, the temperature at the margin was increased to 208° F., and in the centre was doubtless higher. By driving the pole towards the bottom, the water was made to boil up with increased force and noise. There are several other interesting places where water and smoke or gas escape. The water is impregnated with common salt, but not so much as to render it unfit for general cooking, and a mixture of snow made it pleasant to drink."*

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* There are very few hot springs on the earth's surface which exhibit as elevated a temperature as these boiling springs described by Capt. Fremont. Arago says that the hottest in Europe, unconnected with modern volcanic action, are those at Chaudes Aigues, in Auvergne, whose temperature is 176° F.; and the hottest

These springs are in Utah near its western limits. In the immediate neighborhood, the valley bottom is covered almost exclusively

connected with modern volcanic action are, according to Forbes, the Baths of Nero (at Baiæ, in the Bay of Naples), which rise to 176° F.

In Iceland, the surface of the water of the Great Geyser is 185°; the bottom at the depth of 72 feet is 260° F. The neighboring Stokkr is 212° F., or boiling point, at the surface, and 237°.5 at the depth of 15 feet. The temperature of the water of the Little Geysers, or intermitting spouting springs of Reikum, is 212° F. Next to these are the hot springs of Reikiavik, the capital of Iceland, which are 188° F. At St. Michael's, in the Azores, the pool of Caldeira is 208° F. Among the many thermal springs and lakes of New Zealand, there are some of the former as high as 200 to 210° F. In one of the Fidji Islands, at the *Waicama*, or hot springs, near the sea shore, the water is 200 to 210° F. In the island of Amsterdam, in the Indian Ocean, a large basin is formed by a hot spring, the water of which is at the boiling point, or 212° F. Of the same temperature, on the authority of Thunberg, are the Sulphureous Hot Springs of Ussina, in Niphon, one of the islands which constitute the empire of Japan.

But, on the continent of the eastern hemisphere, if we except two or three in Hindostan and Thibet, there are no hot springs of a temperature closely approaching to that of the "Boiling Springs" of Utah. In our own hemisphere, there are only two in Mexico (each at 205°

with chenopodiaceous shrubs, of greater luxuriance and larger growth than had been seen in any preceding part of the journey.

Pyramid Lake is a short distance only from the Boiling Springs just noticed. This, after descending from the pass, broke upon the eyes, a sheet of green water.

In *North or Upper California*, to the west of the Sierra Nevada, which is a continuation of the Cascade Range, and at the foot of the Shasty Peak, is the

Hot Spring of Shasty Peak.—The water is described by Mr. Jas. Dana, in his Contribution to the History of the Expedition by Captain Wilkes, to be hot enough to boil eggs. The region around is volcanic, and the Peak,

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F.), and one in the island of St. Lucia, in the West Indies, at 203° F., which come near to their line of elevated temperature.

From what we know of the increasing heat of the waters of the Geysers and Stokkr below the surface of the spring, and the actual temperature at the margin of the basin of the Boiling Springs, we cannot have any doubt that the water in the centre of the latter does really, not figuratively, boil up; and that its temperature at this spot is fully 212° F., making it equal to the hottest known springs in any other part of the world.

rising to the height of 12,000 to 14,000 feet, with its bare cone and two summits, may be regarded as an extinct volcano. The spring is described as boiling up among the rocks to the height of two or three feet, and as it runs off in a small stream, it has worn the rocks smooth, and formed a small basin below which is much frequented by the mountain sheep.

Acidulo-Chalybeate Spring.—This is also near Shasty Peak. The water oozes out from among the rocks into a basin which scarcely holds a gallon, and then flows down into a marshy spot, thickly covered with an iron crust. It is brisk and pungent, owing to the excess of carbonic acid in its composition. It has, therefore, been called *Soda Water* by the trappers. The taste is very agreeable—acidulous and chalybeate—and as far as we can judge from this test, it contains neither alkaline nor saline ingredients. The temperature is that of the mountain torrent near by.

Fifty yards beyond the spring, there is a shallow ditch, a hundred yards in length, containing about half a foot of water, similarly chalybeate but less brisk with carbonic acid. Our horses, adds the narrator, drank freely of it, and with good relish.

Volcanic Springs.—Under this title, Dr. J. L. Le Conte describes* a number of springs of a remarkable character, some of them resembling the mud volcanoes of Taman, in the Crimea, others the Geysers, or eruptive springs of Iceland. These springs, which were visited by Dr. Le Conte, are in the Desert of the Colorado, in Southern California, in a muddy plain bordering a salt lake. North of the lake, distant six or eight miles, is a chain of rocky hills 800 to 1,000 feet high, portions of which have a volcanic appearance. "Rising from the plain where we now stand are several volcanic mounds, about 100 to 150 feet high. Hastening to one of these, I found it composed of lava and pumice." After telling of the efforts made by the Indians of his escort to dissuade him from his intended exploration, he writes:—

"Advancing towards the place whence the steam issued, we found on the muddy plains numerous circular lakes, containing boiling mud, and exhaling a naphtha-like odor. Many of them are incrusted with inspissated mud, forming cones 3 to 4 feet high, from the apex of which proceed mingled vapors of water, sal ammoniac, and sulphur. Four of them eject steam and clear saline water, with great violence, resembling in appearance the jet from the pipe of a high-pressure engine. The falling spray around these has formed a group of acicular stalagmites, composed of aragonite, with a small quantity of silica, and some saline matter. Many of these stalagmites are tubular in form. Another spring was a large basin filled intermittingly to overflowing, with foam and clear saline water: around the edge were butyroidal masses of aragonite, like that forming needles around the cones. Near the cones, in little fissures, were crusts of what seemed to be sal ammoniac, some of which were colored red, possibly by sulphuret of selenium."

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* **Silliman's Journal, Jan. 1855. No. 55, 2d Series,**

On returning to Vallecitas, whence the party had set out for the springs, they found on the most northern of the volcanic mounds before mentioned, a quantity of scoriæ and obsidian, and distinctly marked the course of a lava stream down the side. The mounds all showed traces of aqueous action, in the terrace-like manner in which the pumice was arranged. Near Vallecitas they passed some mounds covered with cinders and pumice, and on the top of one of them found a crater-like hollow, in which grew some very large canes.

Earthquake. Spouting Springs. — Dr. Le Conte was told by Lieut. Davidson, that while he was stationed at Fort Yuma, in Dec. 1853, a violent earthquake occurred. The ground in the vicinity of the fort opened, forming fissures from which were thrown mud, sand and water. Portions of the mountains several miles around were seen to fall, and about forty miles southeast of the fort, in the direction of some springs, said to be similar to those just now described, was seen an immense column of steam.

Hot Sulphur Springs. — Ascending the mountains which skirt a valley to the west of a desert extending from the Colorado about ninety miles, in Southern California, the traveller comes to a hot sulphureous spring with a temperature of 137° F., near Warner's

Rancheria. It issues in large volume from the fissure of a granite rock.

New Mexico contains many mineral and thermal springs. Several sulphureous springs, some of which are thermal, if we may infer so from the name of the place, are met with at *Ojo Caliente*, to the west of the river Del Norte, 40 miles above Santa Fé.

CHAPTER XIX.

Mineral Springs of Canada—Tuscarora Acid Spring—Charlotteville Sulphur Spring—Ancaster Spring—Caledonia Springs—Their varieties—Gas, Saline, Sulphur, and Intermitting Springs—Mineral Artesian Well, St. Catharine's—Varennes, &c.

MINERAL SPRINGS OF CANADA.

IN the communications of Mr. T. S. Hunt, who was engaged in the geological survey of Canada, we have interesting notices of some of the chief mineral springs of that country.*

THE TUSCARORA ACID SPRING.—The same region in which occur the acid springs of New York offers in Canada a remarkable one of a similar kind. Mr. Hunt describes it with the above title. It is situated in the township of Tuscarora, in the Indian Reserve, about twenty miles north of Pass Dover, which is the nearest point on Lake Erie. The water contains a large amount of free sulphuric acid, about 4 parts in 1000, besides sulphates of the alkalies, lime, magnesia, alumina, and iron in small quantities.

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* Silliman's Journ. New Series, Vols. viii. & ix.

The proportion of these ingredients is, however, inconstant, as is evident from an analysis made in April, 1846, by Professor Croft, of King's College, Toronto, which is confirmed by a partial examination by Mr. Hunt of a specimen of water brought from the spring in 1845.

The specific gravity of the water was much lower, and the amount of foreign ingredients much less, than in that subsequently collected by himself; but the proportion of bases to the acids was much greater.

The principal spring is at the east side of the old stump and gnarled roots of a pine-tree, and has a round basin about eight feet in diameter, and four to five feet deep: the bottom is soft mud. There is no visible outlet to the basin, which, at the time of Mr. Hunt's visit, was filled to within a foot of the brim; fuller, indeed, than it had been a few days previously, although no rain had fallen in the interval. At the centre of the basin a constant ebullition is going on from the evolution of small bubbles of gas, which is found, on examination, to be carburetted hydrogen. The water is slightly turbid and brownish colored, apparently from the surrounding decayed wood, which, indeed, forms the sides of the basin. It is strongly acid and styptic to the taste, and decidedly sulphureous, and the odor of sulphuretted hydrogen is perceived for some distance round the place.

Within a few feet of this was another smaller basin, two feet in diameter, which had about one foot of water in it. It was evolving gas more copiously than the former, and was somewhat more sulphureous to the taste, although not more acid. In other parts of the inclosure were three or four small cavities partly filled with a water more or less acid, and evolving a small quantity of gas. The temperature of the larger spring was 56° F., that of the smaller one 56° near the surface, but, on burying the thermometer in the soft mud at the bottom, it rose to 60° F., October, 1847.

Specific gravity of the water 1.005583. 1000 parts of the water yielded—

Sulphuric acid (SO)	4.6350
Potash	.0329
Soda	.0219
Lime	.3192
Magnesia	.0524
Peroxide of iron	.1915
Phosphoric acid	traces

Representing the bases as combined with their equivalent of sulphuric acid, we have for the composition of 1000 parts of the water—

Sulphate of potash	.06080
Sulphate of soda	.05020
Sulphate of lime	.77520
Sulphate of magnesia	.15395
Sulphate of iron (proto)	.36385
Sulphate of alumina	.46811
Phosphoric acid	traces
Sulphuric acid (SHO)	4.28952
Water	993.83387

The quantity of sulphuretted hydrogen is small, being about one-half of a cubic inch in 200 cubic inches of the water.

CHARLOTTEVILLE SULPHUR SPRING.—This spring is situated a few miles from Port Dover, on Lake Erie. It issues near the bank of a small stream which turns a mill. Temperature (19th Oct.) 45°, while that of the creek was 49°, of the air 26° F. The surface is coated with a film of sulphur. The specific gravity of the water is 1.002712; it is limpid, sparkling, in odor strongly sulphureous, and in taste pungent, with something like sweetness, leaving an impression of warmth in the mouth for some time. A qualitative examination showed, besides, the presence of chlorides and sulphates, the latter in large quantities; the bases were potash, soda, lime, magnesia, with traces of alumina and iron.

1000 parts of the water gave—

Sulphate of potash	.05103
Sulphate of soda	.47182
Sulphate of lime	1.12670
Sulphate of magnesia	.43510
Chloride of magnesium	.08783
Carbonate of lime	.30500
Carbonate of magnesia	.01798
Carbonate of iron	traces
Sulphuretted hydrogen	.17763
Carbonic acid	.15350
Water	997.17341
	1000.00000

The peculiarity of this water is, Mr. Hunt thinks, the unexampled quantity of sulphuretted hydrogen it contains. "The strongest of the celebrated Harrogate Springs (England) yields but 14* cubic inches of this gas to the gallon, while the Charlotteville contains in the same measure 26.8 cubic inches." Amount of solid matter2.49446 parts in 1000.

ANCASTER SPRING.—This spring, which is known to the inhabitants as a salt well, is about two miles west of the village of Ancaster, on the land of Mr. Robert Herlop. Temperature same as that of a neighboring fresh spring of 48° F. The water is extremely bitter and saline to the taste. 1000 parts of the water contained, according to Mr. T. S. Hunt, Chemist and Mineralogist to the Geolgical Commission of Canada—

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* Hunter (*The Mineral Waters of Harrogate*) states the quantity of this gas in a gallon of the water of the "Old Well" to be 156 cubic inches; and of "Thackwray's Pump," 21.

Chloride of sodium	17.82800
Chloride of potassium	.09200
Chloride of magnesium	5.07370
Chloride of calcium	12.80270
*Bromide of magnesium	.10309
Sulphate of lime	.77690
Water	963.32361
	1000.00000

Amount of saline matters 36.67639 parts in 1000.

This water is extraordinary, Mr. H. tells us, on account of the immense proportions of chloride of magnesium and calcium which it contains, the sum of these exceeding the amount of common salt. With almost the same amount of solid matter, it contains less than two-thirds of the quantity of this salt that is found in sea water; in this respect, it is quite unlike any water hitherto described.†

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* Mr. Hunt (Sill. Journ., vol. ix. p. 267, 1850) remarks on the subject of *Analysis of Mineral Waters:* "In the present state of our knowledge, we must, I think, be led to adopt the idea of a partition of bases among the different radicals, so that the bromide of a saline water, instead of being, as is here represented in conformity with general custom, combined as a bromide of magnesium, is divided between the four metals usually present, in proportions which we have not the means of determining."

† The writer, when he expressed this opinion, was not

THE CALEDONIA SPRINGS.—These springs, which are well known as a place of resort during the warm season, are situated a few miles south of the Ottawa River, about 40 miles from Montreal. The fountains, which are four in number, rise through strata of post-pliocene clay, which overlie a rock equivalent to the Trenton limestone. Three of them, known as the Gas Spring, the Saline Spring, and the White Sulphur Spring, are situated within a distance of four or five rods, and the mouths of the latter two are not more than four feet apart. The fourth, known as the Intermitting Spring, is situated about two miles distant, and is much more saline than the others. The first three are alkaline, the sulphur spring strongly so, while the fourth contains in solution a great quantity of earthy chlorides.

I. *The Gas Spring.*—The temperature of the air being 61°.7 F., that of the spring was 44°.4. The discharge was four gallons per

aware of the more than "extraordinary" character of the water of the Artesian Well, at St. Catharine's, in which, we are told, the proportion of the two salts specified by Mr. H. is thirty-five times more than that which he regarded as "immense" in the Ancaster water.

minute, a quantity little subject to variation. The gas discharged was carburetted hydrogen, evolved at the rate of 300 cubic inches a minute. Specific gravity 1006.2. Taste pleasantly saline, but not at all bitter. By exposure to the air, it gradually deposits a white sediment of earthy carbonates. Its reaction is distinctly alkaline to test papers.

Compounds, omitting bases and radicals—

Chloride of sodium	0.967500
Chloride of potassium	.030940
Bromide of sodium	.015077
Iodide of sodium	.000530
Sulphate of potash	.005280
Carbonate of soda	.048570
Carbonate of lime	.148000
Carbonate of magnesia	.526200
Carbonate of iron and manganese	traces
Alumina	.004400
Silica	.031000
Carbonic acid	.349000
Water	991.873503
	1000.000000

Saline ingredients in 1000 parts 7.7775. Carbonic acid in 100 cubic inches 17.5.

II. *The Saline Spring.*—The spring thus named is very similar to the last, but is really less strongly saline. Its temperature was

45° F., that of the air being at the same time 60° F. The specific gravity 1.005824. Its reaction is more strongly alkaline, but otherwise the results of the qualitative examination are similar to those given under the head of the "Gas Spring." It contains no sulphuretted hydrogen whatever; some few bubbles of carburetted hydrogen are evolved, but the quantity is very small. The discharge from this spring is about ten gallons per minute. Amount of solid matter 7.347 parts in 1000. The quantity of free carbonic acid is 14.7 cubic inches in 100 cubic inches of water.

III. *The Sulphur Spring.*—This spring is situated very near to the last, the opening of the two wells being not more than four feet apart. It has a feebly sulphureous taste and odor, and may be said to have traces of sulphur rather than any quantitative return. Temperature 46° F., that of the air being 60° F. Specific gravity 1003.7. Amount of solid matters 4.9406 parts in 1000 parts of water. This is the most strongly alkaline of the group, the soda being 2.12370 in 1000, and the carbonate of soda 0.45580, of lime

0.21000, of magnesia 0.29400. There are traces of iodine and of iron. The large amount of silica (.08400) which it contains is an interesting peculiarity, and naturally connects itself with the strongly alkaline character of the water. As silica is capable of decomposing a solution of carbonate of soda, it is probable that a portion of the soda must really exist in the condition of a silicate.

IV. The *Intermitting Spring* is situated about two miles distant from the others. It rises out of a bank of clay near the edge of a brook. A well has been sunk nearly thirty feet through the clay, and the water rises to near the surface. It is kept in almost constant agitation by the evolution of large quantities of carburetted hydrogen gas; the water, from this cause, is kept constantly turbid by the quantity of clay diffused through it, and it is only after being allowed to stand for several hours in a quiet place that it becomes transparent. The discharge of gas is not regular, some minutes often elapsing, during which only a few bubbles escape from time to time, after which a copious evolution occurs for a few moments, followed by another period of quiescence. From this peculiarity it is called the intermitting spring. Temperature 50° at the bottom of the well, that of the air being 61°. Solid matter in 1000 parts 14.639 parts.

Composition of the water. A qualitative examination showed the presence of chlorine, bromine, and iodine, with potassium, sodium, calcium, and magnesium; a large portion of the latter two exists in the condition of chlorides. No sulphuric acid was detected, but there were traces of iron and alumina.

MINERAL ARTESIAN WELLS *at St. Catharine's, Canada West.*—The only knowledge which I have of this water is through the never very satisfactory medium, in such cases, of a circular for the multitude, in which the marvellous, the doubtful, and the true are commingled. Assuming the printed statements of the results of an analysis by Dr. Jas. R. Chilton to be correct, the saline ingredients of this water are in singularly large proportion, and this too of certain salts which are far from being common, still less abundant, in mineral springs. A pint of the water is represented to hold in solution 5064.15 grains of saline substances, which are equal to nearly five-sevenths of the watery menstruum in which they are dissolved. In other words, sixteen ounces of water hold in solution rather more than ten ounces and a half of saline matters. They are in the following proportions, in one pint of the water; its specific gravity at 60° F. being 1.0347:—

Chloride of calcium	2950.40
Chloride of magnesium	1289.76
Chloride of sodium	781.36
Proto-chloride of iron	13.76
Sulphate of lime	16.32
Carbonates of lime and magnesia	2.08
Bromide of magnesium Iodide of magnesium } a trace	
Silica and alumina	.47
Grains	5064.15

According to this analysis, the proportion of chloride of calcium (muriate of lime) in the water is a little more even than that which is found in the solution of this salt directed by the Pharmacopœia of the United States, viz: one part of the chloride in two and a half parts of the solution. On reading a little further, after the table of constituents of this water, we come to a "Card to the Public," in which we learn that the product of the artesian well is subjected to a certain process of depuration and evaporation, and that "that part which is composed of common salt first settles and is removed; the remainder is dipped into vats until the earthy matter subsides, and then bottled off without any drug or admixture whatever being added thereto." This much we learn from the card signed by three reverend gentlemen; one, a rector, and two, pastors of churches, in St. Catharine's. The more obvious common sense course, in this matter, would have been to procure the attestation of a respectable apothecary or pharmaceutist on the spot, who could have told in intelligible language the changes to which the water had been subjected. The thing was a question of chemistry, not of theology. Now, since the time of Bishop Watson, we are not aware that the reverend expounders of the Gospel have been famous for their love of or advances in chemical science, nor, with few exceptions, have they evinced any fondness for the sciences in general. In any thing connected with the science of medicine, or the art of healing, their opinions are the least to be relied on of any class of men in the community. Only tell them that the object is a good one, that the article or compound, though most probably an old remedy with a new Greco-Gothic or mongrel Indian name, will certainly cure, and there is no quackery too gross, no imposition too transparent, but what will find among the members of their profession supporters, and every now and then volunteer missionaries to disseminate a knowledge of its wonderful effects, and to increase the number of the credulous. The sceptic in religion, who is too indolent or too prejudiced to inquire for himself into the grounds of faith, may plausibly enough doubt the soundness of the religious creed of those who, while they undertake to expound and enforce what is good for the cure of souls, are so negligent of the laws of evidence and the principles of logic in what relates to the cure of the body.

In thus commenting on the certificate of the reverend gentlemen of St. Catharine's, I do not mean for a moment to impeach their purity of intention, nor to deny the proprietor of the Well the benefit of his explanation. One thing seems to be certain, that the water bottled and sent away is a water prepared from that of St. Catharine's Well, but not the water, the direct flow from the vein or veins opened by boring. It may be asked, why this evaporation, and what security is there against a precipitation of other salts, and especially of that of iron, besides the chloride of sodium? Then, again, how is it, if this last mentioned salt had been precipitated by evaporation, and "removed," that it figures so largely in the water analyzed by Dr. Chilton?

There must be wonderful differences in the strength of the saline impregnation of different specimens of this water. A bottle containing twelve ounces was left at the shop of Professor Proctor, of the Philadelphia College of Pharmacy, with the assurance by the person who brought it that it was from St. Catharine's Well, in its original state.

Mr. Proctor's intelligent assistant, J. E. Young, was kind enough to make some examination of this specimen of the water with the following results: Specific gravity, 1.390. Saline contents in one ounce, 164 grains, and in one pint 2,624 grains. This last, large as is the proportion, is only a little more than one-half of the quantity of the salts contained in a pint of the water sent to Dr. Chilton for analysis!

If we might offer any advice to the proprietor of the Artesian Mineral Well at St. Catharine's, it would be: 1. To content himself with the natural water, which is quite active enough for all the purposes to which such a combination is deemed applicable. 2. To get some physician on the spot to speak intelligibly of the properties and medicinal effects of the water; and 3. To procure the services of a less ignorant writer than the author of his present circular. Then shall we not be told of chloride *de* calcium, nor the untruths that iodine and bromine, of which a *trace* only was detected by analysis, are "some of the principal constituents." Nor should we read the nonsense of sodium, a metalloid, "being another body which enters largely into the composition of the water," and of its being "one of the most valuable *salts* yet discovered;" nor the irrelevant matter about sulphuric acid, and its curative powers, as if it were free in the water, and not combined and neutralized by a base of lime, so as to form a sulphate, a salt, which, if not inert, is certainly not friendly to the human organism. The clerical brethren of St. Catharine's ought to have read all this trash before they allowed their names to figure, as vouchers, on the same sheet in which it appears.

Unable to look to any reliable source for information respecting the dose and the therapeutic value of the water of St. Catharine's, I must defer to a future occasion, any remarks on this subject.

VARENNES SPRINGS.*—They are on the southern border of the St. Lawrence, seventeen miles below Montreal. A century ago they were much resorted to, but of late years have fallen into unmerited neglect. There are two springs; the Gas or Inner Spring, inclosed in a house, and the Saline or Outer Spring, distant from the other about a hundred yards. The amount of saline materials in the first is 9.586 in 1,000 parts of the water; and in the second, is 10.721. Both contain chloride, iodide and bromide of sodium, and carbonates of soda, baryta, strontia, lime, magnesia, and iron. The Gas Spring receives its name from the large quantity of carburetted hydrogen evolved. The temperature of the water of the two springs 45°.5 and 47°.5 F.

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* T. S. Hunt.—Silliman's Journal, vol. xi. 1851.

St. Leon Spring.—It is saline and chalybeate, and contains the same ingredients as those of Varennes, with the addition of a larger proportion of iron. The water is kept in constant ebullition by the escape of large quantities of carburetted hydrogen gas.

Caxton Spring.—This spring is situated in the township of Caxton, on the Yarnachiche River, about five leagues from the village of the same name. It also evolves largely carburetted hydrogen. In this respect, as well as in its composition, resembling the spring of St. Leon.

The Plantagenet Spring.—This is in a township from which it derives its name, not far from the southern bank of the Ottawa. The water of this spring bears a close resemblance to the last two waters.

It has not been my good fortune to meet

with any notice of the medicinal uses to which the Canada Springs have been applied; although it is probable that information on this subject has been put on record by more than one of the intelligent and experienced professional gentlemen of that country.

APPENDIX.

I.

THERMAL SPRINGS OF THE UNITED STATES.

	Fahrenheit.
Bennington, Vermont	
Lebanon, New York*	73°
Perry County, Pennsylvania	72° ?
Bath, Berkley County, Virginia	73°
Warm Springs, Bath County, do.	98°
Hot Springs, do. do.	98° to 106°
Healing Springs, do. do.	84°
Sweet Springs, Monroe County, do.	74°

* Professor Mather says, that some of the gas springs in New York, and probably all of them, are thermal, as are some of the acidulous—those of Ballston and Saratoga, for example; and Mr. Hall tells us that all the sulphureous springs in the Fourth District of that State, have a temperature above that of the common springs. Professor Wm. B. Rogers expresses his conviction that a great proportion of the copious and constant springs of the vast belt of mountains occupied by the Appalachian range, especially those of the great limestone valley of Virginia, "are truly though slightly thermal." He notices fifty-six springs which are decidedly thermal, including, in the list, the White Sulphur Springs of Greenbrier County.

Red Sweet Springs, do.	78°
Holstein Spring, Scott County, do.	68°
Buncombe County, North Carolina	94 to 104°
French Broad River, Tennessee	95°
Meriwether County, Georgia	90°
Washitaw, Warm Spring County, Arkansas	140° to 156°
Florida, Sulphur Springs of	70°
Spring near Fort Laramie, Nebraska	74°
Great Salt Lake City, Warm Spring at.	
" " Hot Spring near the	123°
" " . Warm Fountains.	
" " Hot Chalybeate Red Springs, 30 miles from the	132° to 136°
Great Salt Lake, Thermal Saline, north of	74° to 84°
" " Spring Valley, Thermal Saline, south of	70° to 74°
Bear River Hot and Warm Springs, 74 miles N. W. from Great Salt Lake City	134°
Lake Utah, Warm Springs of	
Hot Springs, Oregon	164°
Malheur River Hot Springs, do.	193°
Hot and Warm Springs of Fall River, Oregon	89° to 134°
Hot Springs, Pyramid Lake, Utah	206 to 208°

Hot Spring of Shasty Peak, California.
Hot Sulphur Springs, do. . 137°
Volcanic Springs emitting water and steam.

II.

MINERAL ARTESIAN WELL OF PETTY'S ISLAND.

I omitted to speak, in its proper place, of the chalybeate water of Petty's Island, which is situated in the Delaware River, opposite Richmond, the upper or northern part of Philadelphia. This spring issues from an Artesian well, bored in the summer of 1852, with a view of procuring cool, drinkable water, for the use of the people employed at the ship-yard on the island.

An analysis made by John Hewson, Jr., assistant of Professor Booth, gave the following results, in a gallon of the water:—

	Grains.
Bicarbonate of iron	16.305
" lime	4.360
" magnesia	1.839
" soda	1.611
Silica	3.720
Organic matter	3.100
Free carbonic acid	8.224
	39.159

Mr. Booth thinks that, considering the loss of carbonic acid by exposure and evaporation, its excess above all the bases computed as bicarbonates, would be 17.37 cubic inches.

The water of Petty's Island is regarded by Mr. B. as a true earthy chalybeate, containing an amount of iron (one and a half grains of carbonate in the pint) which is exceeded by only two or three in Europe.

"This water," continues Mr. Booth, "is farther characterized by the large amount of silica which it contains, being nearly half a grain to the pint; and by the absence of sulphates and chlorides; being in this last respect different from all other chalybeates, the analysis of which I have found."*

The water has a diuretic effect as far as can be inferred from a few trials. Of its efficacy in a large circle of diseases in which chalybeates are called for there can hardly be a doubt.

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* American Journal Med. Sciences. Jan. 1853.

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